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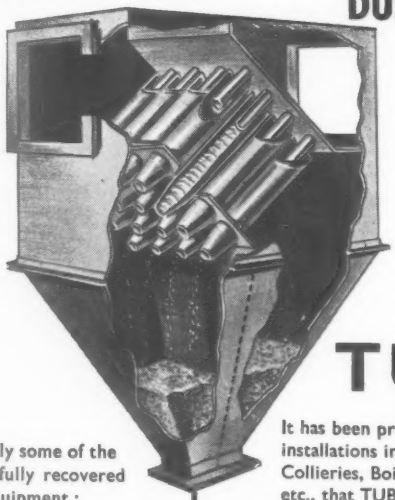

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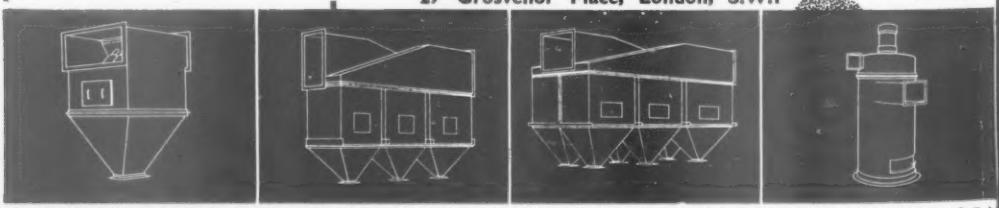

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Future Requirements

In a Speakers Competition to be held in Birmingham, the subject is to be "What Career would I recommend to my Son, and Why." The apprentices at F. H. Lloyd & Company, Limited, are participating and we have been favoured with the script of the principal speaker who puts forward the claim of the foundry industry. His argument is rightly based on the fundamental nature of the craft, which historically has participated in the development of every new industry—be it motor-cars, radio or electronics. He envisages that the foundry would change its traditional aspect to conform with the highest standards of manufacturing conditions. These views are quite sensible, but to maintain this fundamental advantage and to provide for expansion in the manner envisaged, the foundry industry must take steps to ensure such progress.

It is obvious that the plants must be kept up to date; when funds are required for re-equipment they must be available and year by year money must be set aside for this purpose. Depreciation of plant must be a realistic figure, for if there be, working in a competitor's shop, a machine which does a job more quickly and cheaper, then one's own is worth only scrap value. Again, to keep management in a position to handle the types of castings of a character still to be specified for the atomic age, money will have to be spent in reinforcing the industry with a scientific staff capable of appreciating quite new demands which may be imposed upon castings. The industry may have to interest itself much more in the training and acquisition of such men, for there is already, and will be, severe competition for individuals of this calibre. By participating in the training of such men, in such a way as to create an early interest, the industry would reap a rich harvest.

Research, too, must go ahead in all sections of the industry and with it there must be application of results by the industry. We think that in recent times the foundry has very energetically taken up new ideas in every way equal to the rest of the world and in some instances we suspect it leads. That was not always the case, for when browsing through copies of the JOURNAL of 40 or 50 years ago, rational methods of carrying out various foundry processes were put forward which are only just being generally accepted to-day. The few factors which we have stressed are not being lost sight of, but our fear is that far too few foundry executives are actively interested in these matters.

National Brassfoundry Association

Last year was one of almost unprecedented prosperity for the brassfoundry industry, according to the annual report of the National Executive of the National Brassfoundry Association, which was presented at the annual meeting in Birmingham on April 19. This prosperity, the report says, contrasted sharply with the previous year when business was disappointing. The report states "Order books, both for home and export, are full at a time when, with a minimum of restrictions, we have been able to deliver the goods in abundance." Only shortage of labour had limited output but the Association looks forward to the establishment of new output records.

The effect of being busy, says the report, was to minimize "the foolish practice of price cutting." While not favouring exorbitant prices, the Association deprecated reducing them to the point "where the gaining of orders is merely academic since they are unproductive of profit and reduce the standard of living." The results of price cutting could be only instability in the industry —instability of profits, of employment, and of standards of quality. "We hope the lessons of reasonable co-operative action have been sufficiently well learned to stand us in good stead should harder times come upon us," the report adds. During the latter end of last year and since, copper had reached a record high price and this, coupled with some difficulty in obtaining deliveries, had caused anxiety.

Mr. R. P. Allday, who was installed as this year's president of the Association in succession to Mr. C. W. Parkes, referred in his address to the serious labour shortage which was gravely affecting the industry and preventing it from meeting the tremendous demands made upon it especially from the building trade. He also criticized the recent review of productivity in the bronze and brass casting industry published by the British Productivity Council. He said that the report did less than justice to the industry. It was not enough to judge it by the castings process alone, since, although castings were the right process for some products, it had been found that by die-casting hot and cold stampings the industry had greatly increased its output per man/hour and lowered costs. British brassfounders were in many ways ahead of the American industry.

Mr. Edgar Hiley has completed 14 years as secretary of the Association, a longer term that any of his predecessors.

NE Coast Engineers' Elections

Elections to the council of the North East Coast Institution of Engineers and Shipbuilders were announced at the general meeting on April 15. Mr. Percy Lewis Jones, a director of Swan, Hunter, & Wigham Richardson, Limited, was re-elected president, while Mr. John Leslie Batey, naval architect, Hawthorn Leslie (Shipbuilders), Limited, was re-elected as a vice-president. A new vice-president elected was Mr. James Brewis Woodeson, chairman and managing director of Clarke Chapman & Company, Limited.

The following elections were made in the non-associates' section of the council:—Mr. Andrew Thomson Bowden, chief research engineer of C. A. Parsons & Company, Limited; Mr. Norman Carter, technical manager of the Wallsend shipyard of Swan, Hunter, & Wigham Richardson, Limited; Mr. William Muckle, Reader in Naval Architecture, King's College, Newcastle-upon-Tyne; Mr. Richard John Winch Rudkin, shipbuilding manager of the Naval Yard, Walker-on-Tyne, of Vickers-Armstrongs, Limited; and Mr. Henry Paxton Urwin, principal surveyor of Lloyd's Register of Shipping at Newcastle.

British S.G. Iron Producers' Association

A luncheon was held last week at St. Ermine's Hotel, London, to celebrate the completion of the first year's work of the British Spheroidal Graphite Iron Producers' Association. The function was presided over by Mr. P. Russell, B.SC., and amongst the guests were Dr. Pfiel, Dr. Everest; Mr. W. R. Braidwood; Mr. N. P. Newman, J.P.; Mr. H. Morrogh; Mr. V. C. Faulkner; and Mr. Westhorpe (from South Africa) The Association was launched with a membership of 23, since increased to 28, a figure said to represent well over 80 per cent. both of the number of licensees and tonnage produced.

Amongst the major objectives of the Association is the issue of a British Standard to cover the properties of the material; to publicize the notion that s.-g. iron is a new material and not merely an improved form of cast iron; and to ensure that selling prices are a reflection of production costs and not mere guess-work. Naturally the Association is working for a greatly increased output. The improvement in output registered in 1954 was of the order of 66 per cent as compared with 1953, but sales are still too slow as compared with the Continent. Germany has 50 licensees and progress in Australia and South Africa is very marked. The above information was given in the chairman's speech. He in conclusion specially thanked Mr. C. Gresty, Mr. Cooper and Mr. Scoones.

Cycle Traders' Viewpoint

The British Cycle and Motor Cycle Manufacturers' and Traders' Union, Limited, which has its headquarters in Coventry, is taking what it describes as "the unprecedented step" of mailing direct to 7,000 retail and wholesale cycle dealers throughout the United States a series of news letters intended to counteract "harmful and inaccurate propaganda" by the American cycle manufacturers. The Union is anxious that the British industry's point of view on the protection for the American bicycle manufacturers, which has been proposed by the United States Tariff Commission, should be made known before the proposals come before President Eisenhower.

The first news letter describes in general terms Britain's economic position and stresses the importance of its export trade. Subsequent letters will deny such charges (which it is stated are being made in USA) that the British manufacturers are subsidized by the Government and that they rely upon cheap labour. The Union contests the claim that British cycle exports to America are damaging the American industry. British manufacturers, it says, have established a new market in USA and aroused a new interest in cycling there which must eventually benefit the American manufacturers.

Pig Iron Merchants' Association

At the annual general meeting of the Pig Iron Merchants' Association, held on April 26 at the Queen's Hotel, Birmingham, the following officers were elected. As chairman: Mr. Vincent E. Upton (Leigh & Sillavan, Limited); vice-chairman: Mr. F. Arnold Wilson (Wm. Jacks & Company, Limited); hon. treasurer: Mr. C. A. Parson (Parson Limited), and secretary: Mr. S. Owen. The following firms were re-elected to the committee: J. C. Abbott & Company, Limited; Dudley Coal, Coke & Iron Company, Limited; and Charles B. Pugh (Walsall), Limited.

The Foundryman and the Master Patternmaker

Mr. S. H. Russell's Address

At a meeting of the National Society of Master Patternmakers, held in Leicester, with Mr. B. Levy presiding, Mr. S. H. Russell was the guest speaker.

In introducing Mr. Russell, the president said that his record of public service in the ironfounding industry was so long that he could not possibly do justice to it. As a past-president of the Institute of British Foundrymen, as a leader of the Productivity Team, as a prominent office-bearer in the ironfounding trade associations, as an enthusiast for both research and education, there were few whose records could be compared with those of Mr. Russell, and the Society was most fortunate in having him to address them.

Better Methods of Production

Mr. Russell opened his Address by congratulating Mr. Levy and his colleagues upon so successfully inaugurating the Society. He had had considerable experience of trade-association work and he believed the Society was heading in the right direction. In particular he wished to emphasize the importance of better methods of production. To-day, costs of both wages and materials were so high that an engineer would hesitate before ordering a new pattern. Any reduction in pattern cost would hasten the development of better engineering design, cheapen production and help the whole industry. Patternmaking was one of the few remaining industries in which the craftsman still reigned supreme. He believed that no pattern could yet be produced entirely automatically by machine.

The increased demand for iron and steel castings and the amazing growth of the light-alloy casting industry had both led to a demand for more patterns and for new types of pattern. In particular, he was thinking of metal patterns. These required metal-working machinery whilst increased demand for cheaper and quicker production required woodworking machinery and one would think that these two capital requirements together would tend to create larger units in the patternmaking industry. Oddly enough, however, despite these reasons, the tendency for small units to disappear was not reflected by the facts.

Shell Moulding

In the case of shell moulding, a minor revolution had taken place in that the pattern itself produced all the essentials for the mould and the moulder's art had been transferred to the patternmaker who had to produce equipment of extreme accuracy and high finish.

In ironfoundries, the difficulty of recruiting skilled moulders militated against the production of jobbing castings and encouraged both mechanized foundrywork and the making of fabricated assemblies almost devoid of castings. These developments, coupled with the competition from fabrication, threw an ever-increasing responsibility upon the master patternmaker. Economy was essential but it should not be at the expense of efficiency. The following " cost savers " added to the hazards of moulding:—(1) Solid patterns instead of split through the joint line; (2) core-prints with no register to indicate how the core should be located; (3) inefficient registration of loose parts, and (4) loose pieces secured solely by one or two wood screws. In the forefront of the Society's objectives should be the aim for better quality and a better technique which would depend upon disseminated information about the latest techniques to all concerned in pattern production.

The latest developments in foundry practice had made the design of runners and risers into a highly specialized subject and it was encouraging to know that in the United States some standardization of runners and risers had been established in connection with pressure-cast double-sided patternplates, and that this standardization might be established some day soon in Britain. Mr. Russell believed that foundries would, in the end, require the patternmaker to fix the runners not only to plate patterns, but in some cases to loose patterns. For this reason, the science of runners could not be overlooked by the patternmaker.

Apprentices

The patternmaking industry was fortunate in that it always attracted more apprentices than it needed, and he was glad to note that the industry was conscious of the need for careful technical training of apprentices. Mr. Russell did not think that patternmaking apprentices should necessarily devote part of apprenticeship time to work in the foundry. The apprentice should first learn his patternmaking craft really thoroughly, and he should then be given an opportunity to see how the foundry used his products, and after that he would appreciate the moulders' problems and would begin to think how the patternmaker could simplify foundry operations.

It was disturbing to notice how rooted in habit was the old-fashioned moulder. For example, he would rub every core to make sure that it would fit easily. Some moulders would damage a pattern by careless handling. It was up to the patternmaker to produce a fool-proof product. The pattern should have adequate rapping plates and lifting eyes. Mr. Russell thought that where quantity production was involved, there was to-day good co-operation between the patternshop and the iron foundry, but where only a few off were envisaged, there was a

lack of collaboration. He believed that it was all too common for the customer to give an order to the patternmaker who tendered the lowest price. This, of course, might result in poor-quality production. One way to cure this would be to lay down a standard code of specifications so that there would be complete understanding between the customer and the master patternmaker as to the materials and methods and tolerances incorporated in the pattern equipment.

In closing, Mr. Russell emphasized that the foundry industry to-day required men with both wide and specialized technical knowledge. In some respects, the patternmaking industry was a good training ground for men who combined both practical and theoretical ability. He understood that patternmakers imposed a quota upon their intake of apprentices, and without criticising this, he pointed out that the foundry industry would probably make increasing calls upon the men trained by master patternmakers. He thanked the president for giving him this opportunity to address members, and, in wishing the Society every success, he added his conviction that nothing but good could come from its work.

Runners and Risers

The president, in thanking Mr. Russell for his Address, stated with confidence that the Society could not have enjoyed a better address on this subject from anybody. Among the many practical points which had been made, he himself drew special attention to the lesson in Mr. Russell's reference to aluminium and the way it had fallen in price since it was first isolated in 1855. Increased demand was always followed by increased output, and a reduction in costs accelerated both demand and output. He agreed with Mr. Russell's view that in shell-moulding the patternmaker played a major part. Undoubtedly there was some danger to the foundry industry from the competition by fabricated assemblies. Standardization of runners and risers should be tackled by the foundry industry as a most urgent and important matter. He was wholeheartedly with Mr. Russell in his views that patternmaker apprentices should not serve part of their time in the foundry before they had achieved a good working knowledge of patternmaking. In addition, the reference by Mr. Russell to the need for a code or specification for customer and patternmaker was particularly pleasing, because the Society was at this moment engaged upon drafting such a code subject to the approval and assistance of the British Standards Institution.

MR. BROWN endorsed the president's appreciation of Mr. Russell's address, and particularly welcomed the reference to "runners and risers." As patternmakers, they produced pressure-cast aluminium plates, and were usually asked to fix the runners and risers, but invariably the customer's machine-shop was called upon at a later date to machine off the existing runners and risers and replace them in a different position. He feared that the industry was a long way from achieving a standard for the runners and risers because in his experience he had never met even two qualified foundrymen who could completely agree on this issue.

A *Modus Operandi*

MR. RUSSELL emphasized that in America they specified in the first instance where the patternmaker was to fix the runners and risers, and they also specified the precise size, based on a standard specification. The Institute of British Foundrymen was working on this very subject and might some day produce a guide. Mr. Russell firmly believed that the future of the engineering industry depended largely upon intelligent and widespread standardization.

MR. GOTT said that Mr. Russell had been too modest about the foundrymen. Patternmaker should remember that they existed only to serve the foundry. Shell-moulding pattern equipment would be useless unless the patternmaker and foundryman co-operated at the outset. The change in the methods of foundry production had added to the complexity of the patternmakers' art; at one time every foundry had moulders who could use a strickle, but to-day a full pattern was usually required. Foundry "overheads" were growing and as they grew so the importance of good pattern equipment was enhanced.

MR. FOODE said he had been unable to obtain a satisfactory ruling upon where responsibility lay between customer, patternmaker, and foundry, where, the patternmaker having made an incorrect pattern, the foundry therefore supplied an inaccurate casting to the customer.

Clumsy Handling

MR. HARTLEY suggested that someone might urge moulders not to use a spike and a sledge-hammer when rapping patterns. He appreciated the remarks about the need for economical patterns, but emphasized that economy should not be at the expense of skill and service. In answering Mr. Foode's question, his opinion was that the responsibility lay with the company giving the order. He asked Mr. Russell to enlarge on the question of clumsy handling of pattern equipment.

MR. RUSSELL agreed that the cheapest pattern was not always the best and repeated his request for good inset metal rapping plates and strong eyebolts.

MR. GOTT advocated the need for patternmaking instructions to be put down in black and white. With clear instructions there could be no misunderstanding or shoddy workmanship. If the patternmakers were to take the responsibility for choice of methods and design without control of the casting method, this should be reflected in the price. If he was not to take the responsibility then it was vital that the instructions and terms of the order should be clear.

THE PRESIDENT added that many of these points only served to emphasize the need for standard conditions of sale and the need for a code of good practice.

A VISITOR reported that when ordering a new pattern he always instructed the foundry to draw his attention to anything which might cause trouble. He believed that managements should be reminded that all difficulties could be eliminated initially by co-operation between foundry and patternmaker.

ANOTHER GUEST commented that when an engineer wanted a particular line of castings he should give to the foundry the task of ordering the pattern, as the foundry alone should be responsible for the design.

This part of the meeting concluded with a hearty vote of thanks to Mr. Russell, proposed by Mr. Levy and seconded by Mr. Whitehouse.

Other Items Discussed

Re-assembling after a break for tea, the meeting then discussed other items on the agenda, dealing in particular with conditions of sale.

On this subject, MR. FOODE thought that the pattern buyer was in a difficult position when a dispute arose, because in the absence of a standard specification for pattern work he could not prove that the equipment differed from that desired. He therefore recommended that before preparing conditions of sale the Society should first prepare a pattern-equipment specification.

ANOTHER SPEAKER emphasized the importance of pattern equipment producing a casting with agreed dimensional requirements.

MR. EAMES reminded the meeting of the need to specify how many castings would be run off a particular pattern.

MR. BROWN asserted that patternmakers were the finest checkers of inaccurate draughtsmanship in the world, and without any charge to anyone they saved the foundry and engineering industry from untold expense following upon careless draughtsmanship, when patterns were ordered.

MR. LEVY told a story to illustrate the service frequently rendered by a master patternmaker who very often ends up by preparing his own drawing for the pattern he is asked to make.

THE PRESIDENT told the meeting of the Society's decision to prepare a code or standard specification for pattern equipment and he read the report which had been circulated to Council members on November 9, 1954.

Finally, the President concluded the meeting by thanking the visitors for their co-operation in contributing to such a lively discussion, and hoping that those who were now entitled to associate membership would take prompt advantage of the offer.

Census of Blast-furnace Production

A report on the Census of Production for 1951 Volume 3, Trade A, "Blast Furnaces," issued last month by the Board of Trade (HMSO, Price 1s 6d.) relates to establishments engaged wholly or mainly in iron smelting and the manufacture of pig-iron, ferro-manganese and spiegeleisen. Table I gives particulars for 1949 to 1951. The following definitions should be noted:—

Wages and salaries:—These include all overtime payments, bonuses, and commissions, without any deduction for income tax, insurance, contributory pensions, etc. They exclude payments to working proprietors.

Materials and fuel:—The cost of materials and fuel purchased includes all purchases during the year of materials for use in production and of fuel (including oil, gas, and electricity for all purposes, including heating and lighting); all packing materials, including the full cost of returnable containers when first purchased; workshop materials; office materials; water charges; materials for repairs to firms' own buildings, plant and vehicles when carried out by their own work people included in the return; and consumable tools and parts for machinery purchased as replacement, etc.

Gross output:—This is the total value of goods made and other work done during the year; this means the value of sales and work done during the year adjusted for changes in the values of stocks.

Net output:—This is the amount left after deducting from the value of gross output the aggregate of the cost of materials and fuel used and the amount paid for work given out and, for 1951, any transport payments included in firms' returns.

TABLE I.—*Census of Blast Furnaces.*

	1951.	1950.	1949.
	£,000	£,000	£,000
Gross output (production)* ..	121,860	111,342	103,788
Cost of materials and fuel used† ..	94,563	90,761	83,916
Payment for work done on materials given out	156	113	114
Transport payments‡	6,046	—	—
Net output	21,094	20,468	19,759
Wages and salaries of persons employed	12,601	11,778	11,262
	No.	No.	No.
Average number of persons employed	27,795	28,057	27,943
	£	£	£
Net output per person employed	759	729	707
	£000	£000	£000
Stocks at end of year—			
Products on hand for sale and work in progress	1,842	2,599	2,383
Materials and fuel	6,494	6,140	6,671
	No.	No.	No.
Number of establishments ..	46	51	50

* Gross output for 1951 includes payments to other firms and undertakings and to firms' own separate transport organisations for transport services. For other years payments for transport services outwards on finished goods sold are excluded.

† Amounts paid for delivery services are excluded for 1951 but included for other years.

‡ Payments to other firms and undertakings and to firms' own separate transport organisations. For 1951 they cover payments for transport of both goods sold and materials and fuel purchased. For other years payments cover only transport outwards of finished goods sold.

Reinstatement Appeal Refused

A case having serious implications for the foundry industry was heard recently in Edinburgh when T. Wilkie, of Dysart, had his appeal for reinstatement with William Philip & Son, Limited, Mount Pleasant Engine Works, Kirkcaldy, turned down by a majority of two to one by Edinburgh Reinstatement Committee. Wilkie, who is 23 years of age, had only completed his apprenticeship as a patternmaker when he was called up for National Service. He was demobbed in February last. Although unable to appear personally before the committee, he was represented by Mr. J. Blyth, of the United Patternmakers' Union. Mr. Blyth stated that when Wilkie, on his return from Service, approached his former employers, he was told they could not employ him as the work was not there.

Mr. J. L. Forrest, manager of the firm, informed the committee that the work of patternmaking had gradually tapered off in recent times, and it was difficult to find a reason for it. At the moment they had no work for their patternmaker and apprentice. From October 6, 1954, to April 6 of this year they paid 2,227 hours to their patternmaker and apprentice, who only worked 471 hours on patternmaking. Their time was filled in doing joinery and other work about the place. The firm were general engineers and did maintenance work for a number of textile factories in Fife. "We would have been pleased to take Wilkie back," he said. "We normally employ round about 40 hands all told, and since reinstatement started we have taken back 25. With the exception of this one, we have done our duty. If trade improves he would be the first we should asked to come back." Mr. Forrest said they could arrange for Wilkie to get a job as a labourer if he would take it, but he was too good a tradesman for that.

After the committee's decision was announced, leave to appeal was granted. Mr. Forrest repeated the assurance that if work should turn up Wilkie would be the first to whom they would give it.

Jigs at Leyland's

A built-in optical system with mirrors, which magnifies measurements of 0.00015 in. so that they can be visually checked by the operator, is included in an £18,000 jig boring machine which has just been installed in the tool-room of Leyland Motors, Limited. The new machine will help to meet the increasing demand for jigs from the Leyland factories, where all components are jig-machined to ensure complete interchangeability. The facilitate optical centreing and alignment, the machine has an illuminated bent type microscope with a magnification of 24 times which can be fitted to the spindle nose recess.

The traversing table is also graduated with very fine lines, invisible to the naked eye, but which can be seen through an optical system of large aperture that gives an enlarged image of the graduations on a glass screen. Castings for jigs up to 1,750 lb. in weight can be carried on the table which travels beneath the boring spindle head, and the tools provided enable diameters of ½ in. to 12 in. to be bored. The table is moved by hydraulic drive with controls which provide for almost invisible movement. The boring spindle travels crosswise powered by electric motor with an equally fine setting.

A DIVISION of General Motors Corporation is changing over from forgings to shell-moulded pearlitic malleable iron for crankshaft production.

Joint Metallurgical Societies Meeting in Europe

The American Institute of Mining and Metallurgical Engineers and the American Society for Metals have accepted invitations from the Iron and Steel Institute and the Institute of Metals and from the leading Metallurgical Societies in Belgium, France, Germany and Sweden to send representatives to a Joint Metallurgical Societies Meeting in Europe. The dates of the meeting are June 1 to 7 in Great Britain, June 9 to 12 in Düsseldorf (Germany), June 13 at Liège (Belgium) and June 14 to 18 in France.

The objects of the meeting are to establish personal contacts between experts in the USA and Canada and in Europe; to provide opportunities for scientific and technical discussion; to enable visitors from the USA and Canada to see something of the metallurgical industries of Europe; and to foster better understanding and co-operation among all concerned.

The meeting will cover ironmaking (including coke and ore preparation); steelmaking; mechanical working and heat-treatment both ferrous and non-ferrous (including hot and cold rolling, forging, wire drawing and continuous casting, but not the foundry industry); refining and fabrication of non-ferrous metals; heat-treatment; surface treatment (including finishing and coating); metallurgical education and training in industry; research. Most of the technical and scientific work will be conducted by means of discussion groups. Group leaders who are recognized authorities will guide the discussion on each subject and ensure that the leading experts take part.

Thos. Cook and Son, Limited, have been appointed travel agents and managers in Europe, and further details may be had by writing to the secretary of either of the Institutes at 4, Grosvenor Gardens, London, S.W.1.

Pneumatic Tools

A paper having considerable interest for foundrymen was included in the Institution of Production Engineers' Conference on "Compressed Air as an Aid to Improved Productivity," held at Camborne, Cornwall, from April 13 to 14. The title was "Function and Maintenance of Pneumatic Tools" by F. B. Coombes, A.M.I.PROD.E. (chief designer, Holman Bros. Limited). Among the Author's concluding remarks is given a summary of the effects of employing air at the wrong pressure and not in proper conditions, together with the possibility of the tools themselves not being up to standard. These include: (*a*) Chipping tools blunted by prolonged ineffective hammering; (*b*) ratio of fatigue life to useful work accomplished by these tools considerably reduced; (*c*) inefficient speed of grinding wheels resulting in poor work and rapid wheel wear; (*d*) failing of gripping devices and appliances, such as chucks, etc.; (*e*) stalling of air motors used for power purposes and industrial processes; (*f*) rapid deterioration of pneumatic machines due to lack of lubrication and freezing at exhaust outlet; (*g*) high ultimate cost of overhaul and replacement of tools; and (*h*) general reduction in productivity.

Compressed air is described as probably the most flexible and foolproof means of conveying power from one point to another; it is, on the other hand, expensive to produce and unless the transmission line and tools are very efficient the cost per ft. 1lb. of work achieved will be high. Any effort and expense involved to create and maintain this desired efficiency will therefore reap a good dividend and the paper should be of help and guidance towards attaining this end.

Re-designing of Steel Castings to Ensure Soundness and Reduce Costs*

By T. Hurst C.G.I.A.

[ABRIDGED]

(*Continued from page 425*)

Green-sand Moulds

About 50 years ago, it was proved in America that dependable steel castings could be produced in green-sand moulds, but it was not until many years later that the art of pouring steel into a sand mould containing a percentage of water was developed sufficiently to prevent the formation of gas cavities in the steel castings. The proficiency of green-sand practice attained has been enormously helpful to the steel-castings industry, and to the many industries served by it. Its value does not lie solely in the cheaper production of the many types of castings, but also in making castings which would be difficult to produce economically in dried moulds without the risk of hot-tears or shrinkage cracks.

It will be realized from what has been said regarding contraction difficulties that a casting which is so shaped as to make it susceptible to rupture whilst hot, has a better chance to shrink when the sand mould has a high yield-point, or when the sand is "green" or not dried. Railway side-frames and bolsters are excellent examples of jobs suitable for green-sand moulding. In order to reach the pitch of excellence required to produce such outstanding examples, it was necessary first to make sample castings which were cut up and examined, and if they were found to be unsound steps were taken to rectify the faults, either by altering the running system or making adjustments to the casting thicknesses, etc. Co-operation between designer and foundryman is comparatively easy on this type of work, and faults can be rectified as they go along, but the heavy type of casting of the "one-off" variety must be right first time.

Cores in Heavy Castings

It would appear that the design of heavy castings is lagging behind that of the mass-production side of the industry, when soundness and economical production are involved. Perhaps this is because there is not such a widespread demand for this type of casting, due to its being in the nature of a specialist's job to produce, and the facilities for exchange of ideas is limited.

While castings are getting larger and more complicated, the designs chosen, in too many cases, are making the jobs difficult to mould and fettle. One of the major causes for these difficulties is the inadequate supply of holes of the proper size, which will allow the cores to be positioned correctly in the mould and after casting facilitate the fettling of the interior. This omission or inadequacy directly concerns the customer and founder alike, as it is one of the greatest factors affecting the ultimate cost of the job. If the subject were tackled competently by the designer, it could also be one of the most potent factors for reducing costs. Owing to its importance it is necessary to explain the points in detail.

Risks with Chaplets

In heavy castings, it is essential that large internal cores are secured firmly to resist the tendency to float, or lose position. Chaplets between the core and the mould are one answer, but they are very unsatisfactory because of two dangers. The first is the danger of too light a chaplet being used, with the result that it melts before the steel has solidified, thus causing the core to lose its position. If this happens, the pressure of the steel will move the core until it rests against some other solid body such as the mould face, or the next core, with the result that one wall of steel will be cut through, whilst the one diametrically opposite will be twice as thick—which means a scrap casting.

The second danger is that of using too heavy studs or chaplets which, while they support the cores, will by their very size be effective chills, and therefore will not fuse correctly with the molten steel. Such a fault will certainly show up during the fettling operation, and if it is on a machined face will quite probably also result in a scrap casting. If the fault is away from a machined face, it will at the very least require chipping round and welding. Should there be a number of cores, as there usually is in the press platen and cross-head type of casting, the position is so much worse.

A point to be considered from the moulding angle is the necessity of providing means for taking off vents through the cores. Gases evolved during casting are more easily dissipated if allowed to escape in an upward direction. This would be impossible if there were no direct contact with the top part of a mould, such as a top core-print.

The need for controlling the upward lift or displacement of cores by the inclusion of sufficient holes should be removed from the category of requests, and become an essential demand. If the top face of the casting is machined, and holes cannot be allowed, then adequate side holes or bottom holes are necessary, so that the cores can be bolted down.

The removal of the cores in the fettling shop is always a difficult and costly operation if there are insufficient or too-small apertures allowed in the casting. In order to transport heavy cores, it is

* Paper read before the Tees-side branch of the Institute of British Foundrymen, Mr. C. H. Wilson presiding.

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necessary to carry them on cast metal gratings or grids which are rammed up inside the core, and the removal of these gratings is virtually impossible in various cases known to the Author. In some instances, a grid approximately 2-ft. square has had to be extracted through a hole 8 in. dia. In all cases, the gratings are broken up and removed piece by piece from the interior of the casting, and it is easy to visualize the long and difficult task of removing the sand through a hole of the size mentioned before the grid could be smashed.

Hydroblast

A comparatively new aid to easier and more economical fettling is the Hydroblast plant, which, if used correctly, is a direct means to the reduction of costs. By this process, a stream of water and sand is directed under pressure on to the face of the casting, through a nozzle connected to a flexible hose at a pressure in the region of 1,800 lb. per sq. in. The flexibility of application of the Hydroblast is of immense help in removing internal cores and this method well supersedes the slower method of orthodox fettling, which is more injurious to health. However, if there is no outlet for the sand and water, except through the hole into which the jet is directed, the process becomes unsuitable due to the casting being unable to drain itself.

It is not feasible to keep altering the position of the casting every few minutes in order to overcome this difficulty, so the fact remains that on the most expensive and tedious part of the fettling operation, namely the treatment of the interior, the medium most likely to assist in lowering costs cannot be used efficiently, due to design limitations.

The designer may think that a large number of holes will materially weaken the casting, but by beading up the inside edges of the holes, and the judicious placing of internal cross-members, this doubt would be eliminated.

Author's Method

The Author's own firm has adopted a realistic approach to the question of adequate holes in steel castings for the support of cores. At the enquiry stage, the blueprint is studied and the method of moulding is decided upon after due consideration by the planning department and the foreman patternmaker. If any modifications in design are desired, such as the thickening up of any member to assist feeding, or extra holes to support cores, the recommendations are shown on the blueprint in red pencil (which can be easily erased) and together with suitable explanatory remarks for the probable customer's information, the blueprint is returned to him for consideration.

The position is thus clarified at the outset. If the enquiry results in an order, valuable time is saved by the elimination of a lot of correspondence which would undoubtedly follow. Instead, the customer and designer view for themselves the advisability or otherwise of revision before being committed to an order. If the job does not result in an order, the founder has not given away vital secret information, but has conceivably helped to emphasize the need for care when designing or quoting for a casting, and has also helped to put into practice what so many have preached. The requests are based on general principles and not to suit a particular foundry, because if the designer poses a problem, the reaction will be the same irrespective of the foundry which makes the casting.

The question may be raised by the designer as to what in the founder's opinion constitutes an adequate hole. That, of course, depends on the particular casting in question. But in the range of castings that are impossible to shot-blast owing to their size and weight, the answer would be—in the case of a core having at least two outlets—no smaller than is necessary to fettle half the core interior from one side.

An enquiry recently received (Fig. 10), asked for an " apron " for a shearing machine weighing 14½ tons. It was stated that the casting would be water-

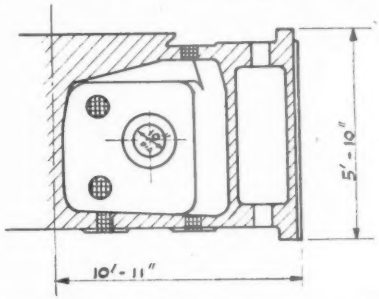

FIG. 10.—*Part section of an apron casting weighing 14½ tons, showing, cross-hatched, where extra ports were requested to facilitate core removal.*

cooled, and the point was emphasized that the cores must be cleaned of all sand. This was, of course, to eliminate the danger of any loose sand percolating into the machine and ruining it through abrasion. However, the apertures provided for on the drawing did not permit the foundry to provide a clean interior. The two main cores of approximately 4 ft. 3 in. by 3 ft. 6 in. by 1 ft. 2 in. had only one aperture each of 10 in. dia.

Owing to the tapering metal thicknesses, it was difficult to maintain the position of chaplets for supporting the cores, and it was impossible to fettle the interior through one hole. The customer was informed of these facts, and provision of extra holes was finally agreed upon. Two 3-in. dia. holes on the same face as the existing 10-in. hole were included, which gave a three-point bearing for seating the core. Two, 6-in. dia. holes were allowed in one vertical face, and one in the other, making five additional holes in each core, which was really the minimum number desirable for cleaning out the interior. Owing to their being relatively small in diameter, the new holes could be plugged after casting and dressed off flush.

A further example of re-designing to reduce costs is given by quoting the method used for moulding chocks (Fig. 11) which are incorporated in a roll-housing assembly. These castings had been made repeatedly and mouded " on the flat." In order to reduce the cost of production, it was decided to depart from this method of moulding and make them " on end," that is, in the position which they take in the final assembly.

The drawback to this, as the design stood, was the difficulty of feeding the bottom metal section, which was heavier in cross-section than at the centre of the mould. The customer was asked to grant the padding up of the outside walls around the core until it was here equal to the thickness of the bottom legs, so that these could be fed adequately. By turning the job on end, the heaviest concentration of metal was located at the top, where it could be controlled by feeder heads. Other advantages in the foundry were that smaller top-boxes were required —a considerable saving in moulding time—and also only one head was needed—which could be burned off in one straight cut—instead of several shaped heads involving complicated burning.

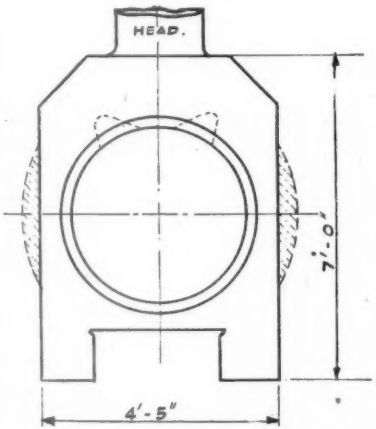

FIG. 11.—*Chock casting for a roll-housing assembly which was modified to enable it to be cast on end.*

The drawback from the customer's point of view was the extra machining required in removing the pads, but when he was told of the other benefits which would accrue, namely sounder castings, with a better surface finish due to the heads being transferred from a face visible in operation, he agreed to the modification. The fettling operation was cheaper in relation to the old method because, owing to a smaller top face in terms of area being required, the danger of sand inclusions was lessened, thereby reducing any chipping out and welding. Any dross present in pouring rose straight into the head.

Cast/Weld Construction

Earlier in this Paper was mentioned the production of a centre-filler casting as a good example of a casting as compared with welded construction, from the point of view of a better-quality product at lower cost. This is typical of the foundryman's opinion that a steel casting is a better proposition than an all-welded construction.

Nowadays, the pendulum is, on certain isolated classes of work, swinging the other way in favour of the welding of two or more castings into one unit to cheapen production. This is because the complexity of the designs requested in some cases has gone beyond the bounds of feasible production as one casting, and the item has had to be broken down into various units. In other cases, it is purely a question of manufacturing costs.

The use of welding has been greatly extended in many branches of the engineering industry, and valuable experience has been gained under the most exacting conditions of service. It is now generally agreed that reliable results can be achieved by welding, provided the proper technique is applied by trained personnel. It is therefore natural that welding should be allied to casting in order to reduce costs.

Obviously, it would be advisable to seek expert welding opinion before a major welding assembly was attempted, because all cast steels do not fall into the category of being readily weldable, due to their higher carbon content, but steels of C 0.2 per cent. to a maximum of C 0.3 per cent. with 0.5 per cent. Mn. can be termed as readily weldable, or as having no undesirable change in the material close to the weld, providing close temperature control is established in the workshops, and the procedure followed after welding includes stress-relieving in the heat-treatment department.

Standardization of Components

One specific case of standardization is that of an American foundry, which was very concerned about the costs of producing tractor spacer-parts. This foundry had to supply as many as five different sets of patterns and coreboxes. This system complicated the flow desired in a production foundry, and it was noticed that there was one prime factor which would enable them to facilitate production; the cast/weld method. In all the castings, the shape of the ends was constant, and the difference lay in the varying lengths of a hollow centre tube, so that it was decided to machine mould the two end-castings, and make up the various sizes required by welding these to the required length of stock tubes. This ruled out the need for five different cores and coreboxes, also different moulding boxes, thereby giving a quicker production time at a cheaper price, both for the original order and any future replacements, because the replacements would be made up from the castings as required, instead of requiring stocks of five different types to meet this contingency.

G

Re-designing of Steel Castings to Ensure Soundness and Reduce Costs

Turbine Casings

One of the most complicated groups of castings made is steam-turbine casings and pressure cylinders, and these can hardly be included in the range known as general castings. Owing to their complicated interior coring, plus additional factors governing solidification, this class of casting is in the specialist category, and it is generally accepted that the surest way to get a sound article is to let the foundries make them who have produced them in the past, and who are aware of the difficulties inherent in this type of work. Now, however, it seems that even these foundries are requesting an easier way out of their difficulties, which are many, and are turning to the cast/weld method of manufacture.

On this type of casting, whichever way the pattern be moulded, there will always be some portions which are difficult to feed satisfactorily, and cooling here must be controlled by chills or special feeder-heads in order to obtain the soundness which is essential at the high pressures required. Another point, which admittedly has always been present, is the difficulty of giving the jobs the thorough shot-blasting and fettling which is necessary to the very often inaccessible regions of the casting due to the twists and turns of the steam ports. No customer could complain if the foundry asked for a simplification of the method of production, so refuting the criticism that too often he has accepted difficult and complicated designs without hesitation. No doubt the request for simplification has been made in the past, and has been answered in the negative due to lack of confidence in the welding operation.

Welding to-day is advancing in skill and application along with many other sections of the steel industry, and the welding operation has been accepted by the customer and inspector as an ally in the casting field instead of an undesirable though necessary means of rectification, with the result that a casting which probably could only be produced by a limited number of foundries can now, by its breakdown into various units, be made by almost anyone. This is good for the trade in general, and certainly better for the customer. Break-up into units, even allowing for the time and cost of welding, would result in a quicker delivery and a cheaper product, because of ease of coring and cleaning. Also, the assembly would be sounder, because the centre main casting would not have the various branches and flanges which obstruct contraction and hinder soundness. These branches and flanges could then be moulded separately by whatever methods the founder thought best to obtain solidity.

Turbine Runners

There are other castings which more readily lend themselves to the cast/weld construction method. One is the runner hub for the hydro-electric plants (Fig. 12). This is, in effect, two separate castings joined together by a number of intermediate vanes. The surface finish of these vanes is of paramount importance and the general service requirements are of the highest standard.

As a one-piece casting, it would be made by the core-assembly method, this being the only way to make the job satisfactorily. A full pattern is not practicable owing to the shape, as between the crown and the skirt would be a ring of intricate cores, and these would be very expensive to make. It has already been said that the way to cheapen production in the foundry is by reducing core-making to a minimum, yet this casting is impossible to produce otherwise than by using many cores. Also, as a one-piece casting the difficulty of feeding would become a problem, because quite often these castings have an overall depth in excess of 6 ft., so making the feeding of the skirt portion very difficult. If local "blind" risers have to be incorporated, these further complicate the moulding of the job.

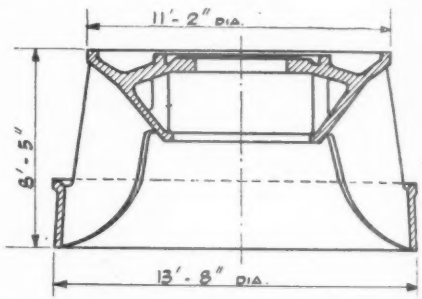

FIG. 12.—*Runner-hub casting for hydro-electric plant, production of which is facilitated by making as two castings.*

If it is made as two castings, which is the best way, the runner crown and the skirt would be joined together by the welded vanes later, and the whole production becomes a very simple and inexpensive operation, compared to the one-piece types. A runner and skirt, of the 12 ft. dia. by 5 ft. deep type, as two castings, cost approximately 600 man/hours to manufacture, as against an estimate of 1,500 man/hours as a one-piece casting, the difference constituting the extra coremaking, closing of the mould, and fettling.

As a two-piece job, a greater portion of the moulding can be done by sweep boards. No gratings need be cast to support cores, and the stripping and fettling would be reduced to a minimum. To elaborate further, whilst in the other method the cost of the cores would be great, the cost of removing them would also entail considerable expense.

One last important argument against a one-piece unit is the probability of hot-tears at the junctions of the vanes, wholly due to selecting the core assembly method. The cores would have to be strong owing to their size and shape, and because of this they would not collapse sufficiently to offset the tendency to hot-tears. The vanes would be insufficiently strong or thick to crush

the cores, and so assist even contraction. The question now asked, therefore, is: "Would it not be better to accept as a cast/weld assembly, with all its advantages, than be compelled to weld the dearer method because of hot-tears?"

Need for Full Information

Much has been written about the collaboration between foundryman and customer in order to make castings at an economical price, but there is an important aspect to be considered, to the same end, namely the foundryman's need for full information from the customer regarding his requirements, and mainly the type of pattern he proposes submitting to fulfil those requirements. Information on numerous factors of production such as machining allowances, specifications, etc., is submitted, but the sales department and estimators are often at a loss when they have to compile a price, due to the lack of information regarding patterns. The bald statement that the customer will supply patterns is not enough, because patternshop practice varies from town to town.

If it is an established customer, the foundry sales department can usually visualize what type of pattern will be sent, and quote accordingly, but if it is a new customer; there is a tendency to play safe and add a margin for the unknown production factors which were not given in the customer's inquiry. With more detailed information to work from, such as an inquiry stating "striking tackle to be used instead of patterns, and also whether outer flanges are to be cored or drawn in to the mould, the customer would receive a true price, which would more than likely be in his favour, and so contribute towards a casting at an economical price. Also, it is in the founder's interest to advise the customer of the method of constructing the pattern, if it is not in existence, to suit his proposed method of moulding.

Future Trends

It is difficult to forecast correctly what the future trends will be in the foundry industry, as new developments become established. The metallurgist and metallurgical and refractory chemists are becoming increasingly important as time goes on, and they are thinking on lines of approach never visualized even five years ago. Just as the old moulder could not have foreseen the wonderful developments that machine-moulding has opened up during the past 25 years, no more can the practical foundryman to-day foresee the great changes which will undoubtedly take place in the future.

Shell Moulding

Possibly the greatest change will be in the development of the shell-moulding, or Croning process. This is a definite advance by the foundry industry towards producing castings cheaply and accurately. By its cleanliness in operation the adoption of shell moulding would be a contributory factor in halting the drifting away from the foundries of the personnel engaged in the practical side of the industry who refuse foundrywork because of the noise and dirt, and the method may even attract more people to founding due to the better working conditions which the process will give.

The claims by the users of the shell-mould process are many; some are substantiated and others are not, but this much is certain, that it will play an increasingly important part in the production of castings as time elapses and more is learned of the process. Such things are Patent rights and the permission to use the process are not under discussion in this Paper, but how the process affects the design of castings.

Under the present accepted method of production, namely by using a metal pattern, the correctness of design to avoid all the pitfalls already mentioned would seem to be even more important than by the orthodox green-sand moulding method. The greatest drawback to shell-moulding at the present time, although it will not always be so, is the cost of the metal pattern. This, because of its nature, would be very difficult to alter in the event of the castings proving unsound, and so it is important that all factors contributing to unsoundness which can be overcome by careful designing must be considered at the outset.

The proficiency achieved by the careful control of green-sand moulding has been of enormous help in the iron and steel industry, due to the speed of manufacture by the various types of moulding machine. To-day, the manufacture of the same castings up to approximately 2 cwt. can, by shell moulding, match the speed of green-sand moulding, with the added advantages of greater dimensional accuracy, and for that reason the customer is interested in it. However, whilst the correction of an aluminium pattern to overcome any faults of the green-sand casting is comparatively easy, it would not be so easy to correct any faults on the iron or steel pattern required for shell moulding. Tests, of course, could be carried out on a wooden pattern, but this does not always give the same result as a casting taken from a production run.

Also, directional solidification must be considered, because the method does not lend itself to the use of feeder heads on the mould joint to feed any concentration of steel remote from the top of the casting, or to be more explicit, a number of heads, plus the pattern and the runner system on a plate, would complicate the moulding, due to the differing shapes.

A further claim made for the process is the reduction of hot-tears due to the collapse of the mould after casting. This is no doubt true, but the ability to achieve greater accuracy must not be carried to extremes by the demands of the customer who needs to reduce his machining to a minimum. To achieve this he might re-introduce sharp corners, so that instead of having to machine $\frac{1}{8}$ or $\frac{3}{16}$ in. off the casting he has only to grind a small fraction of an inch. If this happens, the founder would again be faced with the ever-present problem of sinking in the corners.

Conclusion

Though many constructive studies of casting design have been made for the production of steel castings, it is still the man who is directly concerned

(Continued on page 458 at foot of col. 2)

North British Retirement

The directors of the North British Locomotive Company, Limited, Glasgow, announce in their annual report that Mr. J. B. Mavor, the chairman, and Mr. I. M. Stewart, who are due to retire from the board by rotation, are not seeking re-election. Mr. Mavor has decided to relinquish his appointment for reasons of health, and Mr. Stewart because of pressure of work.

Mr. Mavor, a well-known figure in Scottish industrial and educational circles, is the brother of the late Dr. O. H. Mavor, better known as James Bridie, the playwright. He is chairman of Mavor & Coulson, Limited, the Glasgow manufacturers of mining machinery, the Carntyne Steel Castings Company, Limited, and M. & C. Switchgear, Limited. He has also served on a number of public and technical institutions.

Mr. Mavor's activities in the field of education have included governorships of the Glasgow Academy and the Royal Technical College, Glasgow. In 1953 he was appointed assessor to Dr. T. J. Honeyman in his capacity as Rector of Glasgow University.

Mr. Stewart is chairman of Thermotank, Limited, and associated companies. He is also deputy chairman of Brown Bros. & Company, Limited, and a director of the Engineering Centre, Limited, Glenfield & Kennedy, Limited, Kelvin & Hughes, Limited, and other companies.

Newly-elected chairman of the North British Locomotive Company is Mr. T. A. Crowe, the chief managing director. Mr. Crowe is also chairman of Henry Pels & Company, Limited, and a director of the Carntyne Steel Castings Company, Limited. He has served as a member of council of the Institution of Mechanical Engineers, and of the Institution of Naval Architects, and was elected to the office of vice-chairman of the National Association of Marine Engine-builders for the first time in 1949.

Record Blast-furnace Output

Blast-furnace workers at the works of John Summers & Sons, Limited, Shotton, have set up a new record by producing 9,146 tons of pig-iron from one blast furnace in a week. This is believed to be an all-time record for Europe, but according to Mr. A. B. Stobart, a director, the company soon hopes to do even better.

Another furnace at the works is nearing completion and is expected to come into production in the near future.

Re-designing of Steel Castings

(*Continued from page 457*)

with the manufacture of the many kinds of steel castings every day who has the best opportunity for observing the various wrong ways in which the parts made in the foundry can be proportioned.

The approach at the moment must be from the founder to the designer and it is hoped that gradually, by this method, the designer will become so conversant with the foundryman's problems that he will give them major consideration when a design is first conceived.

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Widow Awarded £3,300

By a judgment issued by Lord Blades in the Court of Session damages totalling £3,300 have been awarded to the widow and four children of an Armadale (West Lothian) steel dresser who died as a result of pneumoconiosis. The widow, Mrs. Annie Cleland, or Nicholson (45), of Wotherspoon Crescent, Armadale, sued for £3,000 for herself, and a total of £2,450 was claimed in respect of her four children, in an action against the Atlas Steel Foundry & Engineering Company, Limited, Armadale.

Alexander Watson Nicholson, the husband and father, was employed in the defendant's dressing shop from 1934 to 1940 and from 1947 to 1949. His work consisted in operating a pneumatic hammer to remove sand from steel castings. His death occurred on June 14, 1951.

Mrs. Nicholson alleged that the defendants should have provided adequate ventilation in the dressing shop and that they did not take reasonable steps to protect their employees against the risk of contracting pneumoconiosis through breathing dust polluted air.

The defendants maintained that their ventilation system and precautions were reasonably adequate.

Lord Blades said he found some difficulty in arriving at a decision regarding adequacy of ventilation in the dressing shop, but in the end was constrained to hold it was not effective and the defendants had failed in their duty.

New Catalogues

P.B. Protective Screen. A leaflet received from the Coleman-Wallwork Company Limited, Windsor Works, Stotfold, Arlesey, Beds., gives details of protective screens which they manufacture for the prevention of accidents due to flying chips arising from fettling operations. The line has been designated the "P.B. Protective Screen."

Radio Isotope Instrumentation and Accessories. The Scientific Instrument Manufacturers' Association of Great Britain Limited, Queen Anne Street, London, W.1, have just published a Buyers' Guide covering the field indicated by the title. The manufacturers' announcements are preceded by a technical article. It is nicely presented and as a useful source of information on this subject it is probably unique.

Pulley-mounted Centrifugal Fans. A four-page leaflet received from the Standard and Pochin Bros. Limited, Evington Valley Road, Leicester, deals with the P.R. Variform range of pulley-mounted fans. It carries an extensive table giving the static head (from one to 6-in. s.w.g.), for volumes ranging from 150 to 6,000 cub. ft. per min. The dimensions of the range, the head and discharge designations and a shipping specification are given on the last page. The leaflet is available to readers on writing to Leicester.

Foundry Plant. Carrying a very attractive-coloured picture of the cupola melting plant—two nine-ton-per-hour furnaces—installed in the works of W. & T. Avery Limited, is a 12-page brochure which has just been released by the Incandescent Heat Company Limited, of Cornwall Road, Smethwick, Birmingham. There is a second excellent picture of this plant on page 2, which brings out the instrumentation installed—now almost a prerequisite of intelligent operation. Besides the cupola and its accessories—including a hot-blast machine—ladles and crucible furnaces are also shown. The brochure is available to readers on writing to Smethwick

Importance of Tees-side Steel Developments

According to Mr. J. Senior, No. 2 Divisional Officer of the Iron and Steel Trades Confederation, Tees-side is rapidly becoming the prime producing area for steel in Great Britain. In his report at the annual meeting of the division, Mr. Senior said that the north-east area's share of the capital expenditure as detailed by the Iron and Steel Board was £62,000,000 and over a five-year period ending in 1958 would cover development schemes at the various works of Dorman, Long & Company, Limited, and the South Durham Steel & Iron Company, Limited. Whereas in 1954 the production of steel ingots was 3,714,000 tons, the estimated potential output in 1958 was 4,750,000 ingot tons for the area.

Production at the works of Dorman, Long & Company, the meeting was told, was scheduled to increase from 1953 to 1958 by 535,000 from 1,765,000 ingot tons. The scheduled increase at the South Durham Steel & Iron Company's works in the same period was 383,000 from 717,000 tons. Output of the Consett Iron Company, Limited, would increase by 243,000 from 607,000 tons.

At the Lackenby works of Dorman, Long a combined universal beam and heavy section mill with an annual production of 400,000 tons was to be completed in 1957. Additional rolling mill capacity would also be installed at the company's Cleveland works, this including new blooming and medium section mill facilities to increase billet production, and a high capacity rod, bar, and narrow strip mill. Output would be increased by 50 per cent. by modernization of the medium plate mill at the West Hartlepool works of the South Durham Steel & Iron Company, while at the company's Cargo Fleet works the medium section mill was to be recognized to increase output and the range of products.

Metallurgists have an "A-line" too

Although new trends do not usually appear in the science of metals with the same suddenness as is often experienced in the world of women's fashions, metallurgists can claim to have developed an "A-line." Reference to the period of transition through which metallurgy was now going was made by Prof. H. O'Neill, president of the Swansea and District Metallurgical Society, at the Society's annual dinner recently. Prof. O'Neill said that they were now passing from equilibrium diagrams and S-curves into what he called the "A-line." This "A-line" had to do with atomic energy. Metallurgists had now come to the stage when they could manufacture unknown metals and use them.

The importance of Swansea in the metal world was stressed at the dinner by the Hon. R. G. Lyttelton, national president of the Iron and Steel Institute and a director of Guest Keen Baldwins Iron & Steel Company, Limited. He said that not only was Swansea the metallurgical capital of Wales, but from the point of view of the variety of metals produced, the metallurgical capital of the whole country.

Tribute to the old craftsman, who was fast disappearing, was paid by Mr. James Griffiths, MP for Llanelly, who said he watched with interest, and sometimes with regret, the technical revolution in the basic industries. The old craftsman worked hard, and the country owed him a lot.

Key Topics in National Economy

Warnings that prices must be kept competitive to secure our export trade, that, whatever happens, coal is bound to be short for the time being, and that productivity in this country may be caught up by other European nations, are given in the Treasury's "Bulletin for Industry." Effects of increasing home and import costs, which do not necessarily relate to each other, in recent months, are considered in the light of competition from other exporting countries.

While the price of most commodities, except notably copper, have fallen from their peak levels in 1954-55, home costs, which are affected by wage increases and eased by greater productivity, have continued to rise. The rise in import prices, coupled with higher costs at home, made more unfavourable the export prices of manufactured goods, which did not change significantly during 1954.

The bulletin gives some statistics on UK productivity last year, which rose for the country as a whole by 3 per cent. more than 1953, and for industry the figure was 4 per cent. above the previous year. Engineering and shipbuilding, however, were slightly below this average increase figure. Comparing UK industrial output per employee with other countries, however, Sweden was 36 per cent. higher, Western Germany 15 per cent., and Holland 9 per cent. In industry, output per employee-hour has not been increased by such a great rate as in the United States, but compared with before the war the improvement is better than any European country.

Summer Prices for Hard Coke

In an effort to improve the distribution of coke by encouraging stocking during the summer, the Minister of Fuel and Power has approved the introduction of a delivered summer-winter price scheme for hard coke produced in coke ovens in areas south of a line from the Wash to the Severn, in the east and west Midlands, and in Yorkshire. It is hoped to extend the scheme to the north-west of England at an early date.

Under the scheme, there will be a reduction of 7s. 6d. per ton in the basic prices of hard coke from May 2 to August 31. From September 1 to October 3 the basic prices will apply, and from November 1 there will be an increase of 5s. per ton for the winter period. During the four summer months hard coke will, therefore, be 12s. 6d. per ton cheaper than in the winter.

The basic prices will be those which are in operation on May 2, subject to any changes authorized from time to time by the Ministry. Coke for blast furnaces and foundries is not affected by the scheme.

Basic Materials Prices Lower

According to the "Board of Trade Journal," the wholesale prices index of basic materials, after rising in the first two months of the year by nearly 4 per cent., declined in March by 0.9 per cent. The fall was mainly due to a drop of 10.7 per cent. in the price of raw rubber.

The continued increase in the price of copper (up on average by 2.6 per cent.) only partly offset this and other price reductions.

The indices for materials used in the mechanical engineering and electrical machinery industries continued their upward movement, and showed rises of as much as 5.4 and 9.4 per cent. over the first quarter of the year

BIF Briefs

The 34th British Industries Fair opens at Olympia, London, and Castle Bromwich, Birmingham, at 9.30 a.m. on Monday, May 2, and closes at 4 p.m. on Friday, May 13. It is open to trade buyers from 9.30 a.m. until 6 p.m. daily (till 4 p.m. on the closing day). The general public is admitted daily from 2 p.m. and all day on Saturday, May 7, but the fair will not open on Sunday, May 8. The public admission charge will be 2s. 6d. (1s. 6d. on Saturday, May 7), when there are the usual party visits from works, educational establishments, etc., to the Birmingham section, The Olympia section includes chemical and chemists supplies; general, transport and sales services; jewellery, silverware, cutlery; office appliances; scientific and cinematographic; scientific and optical. At Castle Bromwich is covered building and heating; electrical and electronics; engineering (including founders and foundry suppliers). Special trains will run from Euston to Castle Bromwich, and Olley Air Services Limited are operating a daily service from Croydon Airport direct to Castle Bromwich airfield. Overseas buyers' clubs and exhibitors' clubs both at Olympia and Castle Bromwich will provide a wide range of facilities and amenities.

Below are appended a few paragraphs concerning exhibits at Birmingham which have special attraction for foundrymen:—

OF PARTICULAR INTEREST on I.C.I. Metal Division's stand No. D.409/308 at Castle Bromwich is the display of wrought titanium products, with emphasis on applications in the aircraft industry. There will also be a wide-ranging display of wrought non-ferrous metal products—copper, brass and aluminium sheet, strip, rod, tube, wire and plate.

A RANGE of Almarine core oils will be shown on Stand D.510 by Fletcher Miller, Limited, of Hyde, Cheshire. The makers claim that fine cores are obtained when using their core oil at only 0.75 to 1 per cent. of the mix. It shortens the baking time, oxidizing quickly at normal stove temperatures of 200-220 deg. C. (392-428 deg. F.) depending on the bulkiness of the core.

THE STAND of Borax Consolidated, Limited (D. 718), will be devoted entirely to a display and demonstration of Boraxo, a powder-type hand cleanser which is claimed to remove grease, grime and chemicals from workers' hands without damage to the skin. The cleanser is used from a vitreous-enamelled steel dispenser, a few taps on the plunger delivering enough powder for each wash.

INDUSTRIAL MOTORS AND GENERATORS will be displayed in a variety of types and sizes from 1 to 500 h.p. by Higgs Motors, Limited, Witton, Birmingham, 6, Stand C601. There will be examples of flange mounting and vertical mounting motors for individual drives, variable speed alternating current motors, change speed motors, loom motors, geared motor units, polishing motors, etc. In addition there will be exhibited a comprehensive range of fractional horsepower motors including split-phase, capacitor-start, poly-phase and d.c. motors.

SPRING BALANCES will be shown by Geo. Salter & Company, Limited, of West Bromwich, at the Birmingham section of the Fair. The firm will have two separate stands. Exhibits on A407/306 will have in the main a hardware application, with kitchen and bathroom weighing machines predominating, but also on this stand will be shown weighers for every purpose together with castings and examples of the Salterpak method of pre-packaging. Other examples of castings and pre-packaging will be on Stand D343/238, where the emphasis will be primarily engineering, with springs, roller bearings, retainers and fasteners alongside heavier and more specialized types of weighers.

MONOMETER MANUFACTURING COMPANY, LIMITED, "Savoy House," 115-116, Strand, London, W.C.2, will be exhibiting the following on Stand N.D. 231/630, at Birmingham. A fully mechanized oil-fired rotary melting furnace, for non-ferrous metals, irons and steels; a semi-rotary oil-fired melting furnace; an hydraulic oil-fired lip-axis crucible tilting melting furnace, for all non-ferrous metals; and a valve-outlet gas-fired lead-melting furnace, with fully automatic temperature control. Of particular interest to the iron industry is a hot-metal receiver, for holding irons as tapped from the cupolas at pouring temperature for long or short periods, thus ensuring a supply of hot metal at all times.

AN INTERESTING EXHIBIT of Electromagnets, Limited, Boxmag Works, Birmingham, 19, on stand C605 will be a high-intensity electrically-energized road and runway type magnetic sweeper complete with self-contained petrol/electric generating set. Numbers of these machines are in use in various parts of the world for clearing roads and runways of dangerous ferrous material which causes considerable damage to pneumatic tyres. Supporting exhibits will comprise a high intensity patent electromagnetic conveyor head unit built into shortband conveyor with vibratory feeder, super intensity electromagnetic chute separator and various types of permanent magnetic separators and floor sweepers.

"HEAT FOR INDUSTRY" is the main theme of the Gas Council's exhibit at Castle Bromwich Stand No. D641/540. The three main sections of the stand will be devoted respectively to the plant maintenance and repair shop, direct-fired air heating for processes, and the pottery and ceramic industries.

The Gas Council Coke Department stand will feature a new type of completely automatic large-coke-fired boiler, for heating factories, office blocks, etc., also, an industrial coke-fired high-efficiency furnace will be shown in its applications in industry.

Part of the stand will be a lounge, where technical literature will be available, and advice on industrial processes and heating problems can be obtained from the expert staff in attendance.

LANSING BAGNALL, LIMITED, Basingstoke, Hants, (Stand C.628/727, Castle Bromwich), intend to base their display on actual demonstrations of materials-handling trucks. Parts of the stand are to be arranged to represent industrial conditions in which the SFR 225 reach fork truck will be put through its paces. This truck has a capacity of 2,500 lb. and can stack 40- by 40-in. pallets at 90 deg. in gangways less than 6 ft. wide. The mast assembly can be extended up to 32 in. forward, so that while the load can be carried safely within the wheelbase, it can be deposited or picked up by "reaching," without interference from the protruding straddle arms. It can raise loads up to 10 ft. high and has an electric drive and hydraulic lift which ensure smooth operation. A stand-on platform is provided for the driver. The lightweight pedestrian-controlled PF 100 fork-truck with a capacity of 1,000 lb. and the PP 230 pallet truck will also be shown. Three tractors are included—the power tug with a drawbar pull of over 700 lb.; the AFS tractor with a Ford 10 engine; and the Diesel-engined TD 220 tractor. The last two have a drawbar pull of 2,000 lb.

Aspects of Metallurgical Control in the Modern Steel Foundry*

Discussion of Mr. N. Y. Newton's Paper

At a meeting of the London branch of the Institute of British Foundrymen held in February, the chairman of the branch, Mr. W. Wilson, presided. Following the reading of apologies for absence by the secretary and the adoption and approval of the minutes of the last meeting, the chairman introduced the lecturer. Mr. N. Y. Newton, he said, as members would probably recall, was awarded the first prize for his Paper in the London branch section of the National Jubilee Competition last year, and was now to present that Paper. He was a young man who was at present taking a considerable interest in shell moulding on the development side of the company by whom he was employed—(K. & L. Steelfounders & Engineers, Limited).

MR. NEWTON introduced his Paper by saying that is was essentially the same as he had sent in a year ago, but he had taken the opportunity of including some more illustrations because a limit had been imposed on illustrations for the competition. He thought these would add to the general interest and amplify several aspects.

(Mr. Newton then proceeded to read his Paper.)

Value of Complete Records

Opening the discussion, the CHAIRMAN (Mr. W. Wilson) said he could well remember when metallurgical control records were very much frowned on in the industry. At one time, he had been at a steelworks in Scotland and after being there a few months an order was received from South America for a quantity of steel " as supplied before " yet of which there was no record. Fortunately, however, the laboratory solved the problem and found that the previous quantity of steel supplied had been from an obsolete furnace. Members could imagine what a task the metallurgist had in making a comparable charge, but that example did show the advantage of keeping metallurgical records.

MR. W. G. MOCHRIE asked if there was a standard size of test-piece which was put into the annealing or other heat-treatment furnace. Was it always of the same size and shape, and if so, did the mechanical properties of the test-bar reflect the properties of the casting, or the properties that would be expected from the heat-treatment of the test-bar?

MR. NEWTON said there were several sizes of test-bar, but three were in general use. The first had been shown in one of the illustrations; this was attached to the casting and went through the normal processes. It was tested by the inspector and showed properties which were representative of that material as heat-treated. Of the two other types of test-piece, one a block about 1¼ in. thick and 10 in. long which was often used and there was also the clover-leaf test-bar. From the latter it was possible to cut three specimens, for impact, tensile and bend tests.

The second point was a recurrent one. It could be said that a test-bar showed what properties would be found in a perfectly sound piece of steel of a particular chemical composition, made under certain melting conditions and given a standard heat-treatment. Castings and the test-bar representing them were carefully kept together always during processing. Castings had been sectioned and results obtained from test-bars machined from the pieces which compared favourably with those given by test-bars of the same metal. It had to be remembered however that factors such as micro-shrinkage always played an important part in tests results. If there was a modicum of micro-shrinkage then the material might show very poor ductility figures and the like. As a general rule, the test-bar would be treated under standard conditions and if it gave satisfactory properties, then it was known that the metal was satisfactory.

Section Thickness

MR. MOCHRIE said he had really been considering the effect of thickness of section. For a casting of a fairly thick section, was more time given in the furnace during heat-treatment, or did it mean that the same design of test-bar might sometimes have twice as long in the furnace as others?

MR. NEWTON replied that if the test-bar was cast on to the casting they both went through the same heat-treatment cycle in the furnace—they would have the same time. Normally, however, in the cases of steels with which he had dealt in his Paper, any increase in soaking time, over and above that which was essential, did not affect the mechanical properties of the steel appreciably.

MR. BERESFORD asked if the question of sand came within the consideration of Mr. Newton's work. He had been surprised to hear no mention of it in the Paper.

MR. NEWTON pointed out in reply that his Paper was concerned with metallurgical control and he had not mentioned sand because that subject would demand a full paper on its own.

Science Hand in Hand with Labour

MR. KEEBLE said members had seen a good illustration in the lecture of the Institute's motto: " Science Hand in Hand with Labour." He referred to the checking of the temperature of metal at the furnace. A spoon sample was shown being poured, carefully observed by the leading hand and then a few minutes later the use of the immersion thermocouple had been exhibited. He did not know which

Paper printed in the JOURNAL November 25, 1954.

was supposed to be confirming the other! He asked Mr. Newton if he had any views on the value of fluidity tests for determining correct pouring temperatures. He referred to the work which had been done in America and, of course, in this country by Dr. Kondic, in which both English and American workers had used the fluidity spiral tests whereas German workers had used straight rods. He would be interested to have Mr. Newton's views on such tests as an instrument of metal control.

Pinhole porosity had been illustrated in the Paper, and he was sure it was a source of satisfaction to non-ferrous foundry colleagues to find that pinhole porosity was not confined to their particular branch of foundrywork.

A paper had been published recently entitled "Hydrogen, Barrier to Progress," by one of the leading figures in the welding world. The illustrations shown that evening on the screen and members own knowledge and experience of non-ferrous founding allied to the experience of welders brought founders also to the common issue—that of hydrogen as a menace to liquid metal manipulation.

A last point. It was customary to make an analysis of the causes of scrap and there had been in recent years a multiplicity of papers on the wisdom of analysing one's scrap. He repeated the plea, however, which was made by the lecturer, indirectly, that less emphasis should be placed on sorting scrap and more emphasis on the positive approach of specifying definite methods of working before the job got to the foundry floor. The point had been made by the lecturer in his reference to the great importance of the liaison with a methods-department. He would place a positive value on the great value of such close co-operation. Indeed, if the foundry industry was to prosper, as it would, the emphasis should be upon the methods approach, initially, rather than upon *post mortem* activities.

MR. NEWTON said as far as fluidity was concerned he had not altogether given up hope that founders might be able to use such a test but his experiences with the fluidity tests rather convinced him that it depended on whether the operator really wanted to make the test work or not. It had always seemed most difficult to reproduce standard operating conditions—a flick of the wrist when pouring could produce metal which seemed to run a long way on the test spiral but perhaps not very far in a casting. He still felt that such tests should be followed up because founders could not have too many control methods. Steelfounders found it difficult to explain when they had a heat which was not going too well; everyone concerned said they judged the temperature correct at the furnace and the pyrometer was used and when the metal was poured it looked satisfactory, but the castings somehow were mis-run. The more metallurgists could do in applying control, as long as it was a simple test which did not use much time, the better, but he thought fluidity tests were so critical that to apply them on the shop floor would always be difficult.

Where to Inspect?

MR. WHIPP said he had been rather surprised to see from the charts which had been shown that inspection was well down the list. It seemed to him that much work was done before a casting came under inspection. It had passed through the shot-blast plant and the annealing furnace and was then inspected. Under such a system a faulty casting could surely cause much waste of time?

He understood that each melt was given a number which the test-bar carried, but he would like to know how the castings were segregated and identified with the test-bar. Presumably, if the casting was a heavy one it might spend a much greater time in the fettling shop and so come through much later than a lighter casting cast along with it. How were the castings segregated and how was it ensured that they were tied up with the proper test-bars?

MR. NEWTON said in reply to the first query that everyone in the foundry was on the lookout for scrap castings. If when a casting was knocked out there was a piece missing, or something else about it which someone did not like they had only to go to an inspector to get the matter looked into. If, during processing castings before the actual inspection, some fact was noticed about which the personnel were not satisfied they could go to the metallurgist or the head foreman and have it looked into. Frequently, he had been in the middle of another job when someone had come running to report something which did not seem to be correct and he had dropped what he had been doing and gone to look into the matter. It was only by keeping confidence between the laboratory staff and the practical men and the inspection department that a system such as theirs could work.

There had been many laboratories in the past at which the practical men had rather "looked down their noses." His objective was to prove that by personnel working together as a team a careful check could be maintained on castings throughout the processing. When castings were coming through the shop in process sequence, inspectors everywhere would mean too many inspectors. It was rather a matter of everyone keeping their eyes open and reporting anything which was not quite right.

The second point was a ticklish one. In the main, he thought it could be answered by saying that where it was of great importance an endeavour was made to have a day number or a serial number on the casting and the test-piece. In the case of large jobs, it was fairly easy. If there was a batch of wheels to make, the cast number would be placed on the test-bar and casting sheets were made out and the moulder's job was to go round and book down the castings. In the case of smaller castings, a day-number system was used which depended on the type of casting made, and that was picked up at a later stage.

MR. WHIPP asked if that was found to be the best way.

MR. NEWTON replied that no attempt was made to segregate individual casts of metal for heat-treatment. They aimed at a chemical composition for

the steel which would respond to a standard heat-treatment to give satisfactory results. The castings arrived in the fettling shop and went into the oven for a standard heat-treatment. When they came out of the oven they should be satisfactory and castings were checked with the Brinell-hardness machine to make sure that they were correct. A fair amount of latitude was permissible in the heat treatment required to meet test specifications.

Causes for Rejection

MR. WASH pointed out that Mr. Newton had stated that compositional limits for the castings were worked to and he had also said that if they did not conform to these limits the metal was rejected. Was it to be understood from that if, say, a 0.30 per cent. chrome steel was being aimed at and accidentally 0.35 per cent. was sound, that that batch of castings would be rejected, or would they try heat-treatment to get the batch of castings within the property limits?

MR. NEWTON said that castings were never rejected " out of hand." If a 0.30 per cent. carbon steel was wanted, limits of 0.28 to 0.32 per cent. were specified, and then if the composition of a melt came outside that the metallurgist had to consider the question of obtaining the required properties. If something went wrong, from past experience it was decided whether the properties required from the castings could be obtained and if it was thought they could not from the standard heat-treatment, then they would try to formulate another heat-treatment process which would give the correct properties. Sometimes, it might be necessary to go to the customer and tell him that if such and such a heat-treatment were given it would give the properties required. It was surprising, in these matters, how far one could go by heat-treatment. Actually there was wide latitude, but a case did sometimes arise when the metallurgists were worried and then had to scrap the castings because the firm had a reputation for quality to maintain.

Brinell *vis-à-vis* Tensile

MR. A. R. PARKES wanted to know if Mr. Newton could confirm that the results of the Brinell test had a good relation to those from the tensile test for all grades of steel. Secondly, Mr. Newton had mentioned that samples were taken from incoming raw materials. Was it found that there was extensive contamination in the incoming scrap from alloy steel, and if so, how was it dealt with? Did it mean very extensive sampling?

MR. NEWTON agreed that the Brinell/tensile relationship was, in his experience, fairly good in any particular foundry or for any particular Brinell machine. He thought it could usually be said that some variation could be expected, say, two tons per sq. in. up or down on a standard equivalent. If a batch of castings from a heat-treatment oven showed similar Brinell-hardness readings and a test-bar from one of the castings showed satisfactory properties, then they were satisfied that the properties of all the castings would be comparable. The Brinell test was a simple means of measuring quality.

As to the second query, generally, the scrap was examined as it came in and it was purchased from reliable sources. The checking was not always as easy as it sounded and occasionally he had heard of cases when someone had seen something which looked like steel but which was not. There was a case of some copper which was iron clad and no one had noticed it in the railway wagon along with a lot of other scrap. It got into the melting furnace and there were some castings produced with five per cent. of copper in them, naturally these castings were rejected. It was not customary to sample each piece of scrap but to proceed as experience dictated.

MR. LEVY also referred to the question of relationships between Brinell and tensile. Recently he had had experience of a firm taking a Brinell test which came well above the required minimum, close to 200, on cast iron. (There might be different relationships with cast iron from what there were with steel, but he was interested in cast iron.) Although the Brinell was approaching 200 the tensile was down to about 15 tons where, according to the book, it should have been nearer 20 tons. That was rather a wide margin of discrepancy, but it did indicate how wide of the mark one could be when assuming that if the Brinell was correct the tensile would be accurate.

MR. NEWTON said that for iron castings it would be more difficult to get co-ordination than it was in steel, as 22 tons to 200 Brinell for iron would be about 43 tons to 200 in steel. He thought the graphite caused a discrepancy with cast iron.

MR. LEVY then asked if Mr. Newton had had experience of taking test-pieces out of the casting, instead of integral or separately-cast test-bars. His foundry had come up against variations in different sections of the same castings.

MR. NEWTON said he had had that same experience and tried to discourage customers from taking sample bars from castings.

Vote of Thanks

MR. BARNARD, proposing a vote of thanks to the lecturer, said he thought members had had an excellent paper and it was now clear why it had received the Jubilee Competition award. Personally, he had nothing but praise for Mr. Newton for his exposition which had proved most interesting. He had been amazed at the care which had been taken to assemble all that information on the steel foundry; it showed the engineers—and he noticed there were some of them present—that in the steelfoundry industry, at any rate, their needs were being well catered for.

MR. L. G. BERESFORD, seconded, and MR. NEWTON, in reply, said it had been a great pleasure to come along and he greatly appreciated the very good attendance, for he knew there were not many steelfounders in the London area.

Sharp Rise in UK Imports

Further widening of the trade gap is shown in the provisional figures for United Kingdom imports and exports in March and in the first quarter of this year. Exports last month, in which there were 27 working days, totalled £260,300,000. In the first quarter of 1955 exports averaged £247,300,000 a month, 10 per cent. more than in the corresponding period last year. Taking the six months' period from October, 1954, to March, 1955, together, which includes last October's dock strike, exports were 3 per cent. more than in the corresponding period a year previously.

Imports in March, however, were valued at £365,400,000, although this figure reflects many orders placed last year. The average for the first quarter was £335,500,000 a month, 23 per cent. more than in the first quarter of 1954. Re-exports in March amounted to £12,700,000 and in the first quarter averaged £10,600,000 a month. The excess of imports, valued c.i.f., over exports and re-exports, valued f.o.b., was, therefore, £92,400,000 in March and £77,600,000 a month in the first quarter.

Exports to North America in March amounted to £26,500,000, bringing the average for the first quarter of 1955 to £23,700,000 a month, compared with £22,400,000 a month in the corresponding period of 1954. Last month exports to the United States totalled £15,700,000. The first quarter average of £13,900,000 a month was £2,000,000 more than in the corresponding period of 1954 and equal to the level reached in the middle of 1953, before the recession in United States business activity significantly affected her imports. To Canada, exports in March were valued at £10,800,000, bringing the average for the quarter to £9,800,000 a month, compared with £10,500,000 in the first quarter last year.

Mechanical Handling Aids Productivity

Every time anything in a factory—raw materials, materials in process, finished products, materials for maintenance, construction, and scrap—is moved from one place to another, something is added to its cost and nothing to its value, says the British Productivity Council's latest action pamphlet, which deals with the handling of materials. Of a total wage bill in British manufacturing industries of £2,500 million, one sixth to one third can be attributed to handling. Perhaps more important is the fact that 28 per cent. of accidents causing loss of time in industry are caused by inefficient handling at a cost of £19,000,000.

The pamphlet says that where materials handling is necessary, it should be regarded as an integral part of the production process. It was possible for it to account for as much as 85 per cent. of the cost of production in the extreme instance and it is not unusual for 50 tons of materials to be handled for every ton of finished product.

A vast increase in productivity can be achieved by improved handling, the council believes. On the average it could be raised 15 per cent. without any change in the existing machinery with an uninterrupted flow of materials to and from each worker. A piece of new equipment might take five years before it saved enough money to pay for itself, but, the pamphlet says, a fork-lift truck can pay for itself in two.

THE UNIVERSITY OF SHEFFIELD, now 50 years old, is to celebrate its jubilee by opening its buildings to the public on three days of this month—April 28 and 29 from 2.30 to 7 p.m., and April 30 from 2.30 to 8 p.m.

He Gave Life to the "Queens"

The Atlantic crossing is to-day still graced by the two great Cunarders Queen Mary and Queen Elizabeth, embodying the best of British shipbuilding genius and Clydeside craftsmanship. Yet little over 20 years ago the former was the abandoned hulk of No. 534 on the stocks of John Brown & Company's yard. That she ever went into the water was due almost entirely to the personal efforts of Baron Kirkwood of Bearsden to give employment to the Clydebank shipworkers. Baron Kirkwood died on April 16 at the age of 82.

He fought for two years to secure financial aid from the Government for the completion of the liner and at the end of 1933 he succeeded. At the launch in 1934 he was given a place of honour as Mr. David Kirkwood, MP for the Clydebank Dumbarton Burghs. Later, when there was talk of placing the contract for a sister ship on the Tyne, he declared in the Commons that John Brown's at Clydebank was the only place that the Queen Elizabeth could be built.

Lord Kirkwood's journey to Westminster was full of adventure. Early in his working life he was apprenticed to an ironworks at Shettleston, and at the age of 22 he entered the Parkhead Forge of William Beardmore & Company, Limited, and was soon involved in an engineers' strike. He organized shop stewards and was to take a prominent part in a series of unofficial stoppages for better wages, which culminated in 1916 in his deportation from Glasgow to Edinburgh under the Defence of the Realm Act. And yet he showed himself able to devise improved methods of munitions output; when he was reinstated as a foreman of the Mile End shell factory the period coincided with a record output of shells.

After the first world war he turned to politics and entered Parliament in 1922. There he was tireless, eloquent, even vociferous, in his championing of the cause of his Clydeside constituents. The years mellowed his character and he was finally to take on the mantle of an elder statesman. Lord Kirkwood announced in 1951 that he would not seek re-election and on the dissolution of the Labour Government a baronetcy was conferred upon him.

Overseas Trade Enquiries

Details of trade inquiries made by companies overseas concerning British manufactures are given below. Unless informed otherwise, interested manufacturers are advised to communicate (by air mail if stated) with the inquirer at the address given. At the same time they are requested to notify the local overseas representative of the UK Government, whose address is also given below, of any action taken. Any correspondence with the Export Services Branch of the Board of Trade, at Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, extension 776), should bear the appropriate BOT reference, which is quoted in parentheses at the end of each inquiry.

ABDULLA Y ABDEL GHANI, PO Box 2, Taif, Saudi Arabia, wishes to contact UK manufacturers of shallow-well, slow-speed, Diesel-driven, water pumping sets and spares. Notify the Commercial Secretariat, British Embassy, Jedda. (ESB/4855/55.)

DALI B. SHROFF & COMPANY, Post Box 973, 361 D. Naoroji Road, Bombay, 1, India, wishes to purchase from the UK 30-50 tons per month of chemically pure or fine lead ingots. Notify the UK Trade Commissioner, PO Box 815, Mercantile Bank Building, Mahatma Gandhi Road, Bombay, 1. (ESB/7745/55.)

Oxide-film Formation on Molten Cast Iron*

By R. Merz and B. Marincek

It is well known that an experienced blast-furnace foreman can, by observation of the oxide skin on the surface of molten pig-iron, assess the composition of the metal. In a similar way the oxide-film formation on molten cast iron is of importance, because if this film forms during pouring of castings, it can be swept into the moulds and may, after solidification, become the cause of local unsoundness. The process of centrifugal casting is particularly sensitive, as an oxide film can produce leaking pipes.

When molten cast iron comes into contact with air, it will be oxidized by the oxygen in the atmosphere. The oxygen dissolved in the melt will first oxidize those alloying elements which possess the highest affinity for oxygen. At low temperatures, silicon will be oxidized first, at the same time some of the iron will be oxidized to form ferrous oxide, although iron has a lower affinity for oxygen. Part of this ferrous oxide will remain in the molten iron, the remainder will separate and, combining with silica, will form the solid oxide film. The film immediately reforms when the existing film is removed. If the temperature of the molten iron be raised, fissures are formed in the oxide film which become more pronounced with rising temperature, until finally the oxide film disappears and the surface of the metal becomes clean.

Effect of High Temperature

The disappearance of the film is caused by the fact that the affinities of the alloying elements towards oxygen undergo dissimilar changes with rising temperatures. In particular, carbon behaves differently from other elements. On reaching a certain temperature the tendency of carbon to combine with oxygen to carbon monoxide becomes stronger than that of silicon, thus carbon will take oxygen from the silica according to the equation

$$SiO_2 + 2\,C = Si + 2\,CO$$

There is then no more silica left to react with the oxide film, the film disappears and carbon monoxide burns on the surface of the molten metal with a bluish flame. On cooling, the oxide film reappears and the temperature at which the oxide film forms can be called the "oxide-film formation temperature." This temperature depends on the composition of the molten iron, and the influence of alloying elements contained in cast iron was experimentally established by the Authors in numerous experiments based on synthetic irons.

* From the metallurgical laboratory of the Swiss University of Technology, Zurich, abstracted from *Stahl und Eisen*, Feb. 24, 1955.

Conclusions

These experiments led to the following conclusions: The chemical composition of the molten iron decides the temperature of the oxide-film formation. The normal alloying elements in cast iron exert influences of varying intensity which are dependent on their concentration.

Carbon.—Low-carbon contents of from 2 to 3 per cent. C. reduce the temperature of oxide-film formation to the extent of 6 deg. C. for every 0.1 per cent. rise. Higher carbon contents of from 3 to 4 per cent. C. reduce the temperature of oxide-film formation only to the extent of 2 deg. C. for every 0.1 per cent. C. rise.

Silicon.—Low-silicon contents of up to 1 per cent. Si increase the temperature of oxide-film formation to the extent of 1 to 10 deg. C. for every 0.1 per cent. Si rise (inversely to carbon content, that is lower figure for high carbon, higher figure for low carbon). Higher silicon contents up to 1 per cent. Si increase the temperature of oxide-film formation to the extent of 0.2 to 1.4 deg. C. for every 0.1 per cent. Si rise.

Manganese.—Low-manganese contents considerably reduce the temperature of oxide-film formation especially when silicon content is also low. Amounts up to 0.8 per cent. Mn reduce the temperature of oxide-film formation to the extent of from 12 to 30 deg. C. for every 0.1 per cent. Mn rise. Higher manganese contents over 0.8 per cent. Mn are without practical influence.

Phosphorus.—Phosphorus contents increase the temperature of oxide-film formation only slightly. The increase is about the same as that of silicon for over 1 per cent. Si.

Sulphur.—Sulphur has the strongest influence. Low-sulphur contents up to 0.1 per cent. S increase the temperature of oxide-film formation to the extent of 12 deg. C. for every 0.01 per cent. S rise, thus with higher sulphur-contents present, the oxide-film will form too soon on cooling and will be swept into the mould. Sulphur contents over 0.1 per cent. S increase the temperature of oxide-film formation only to the extent of 0.6 deg. C. for every 0.01 per cent. S rise.

These figures show how the composition of the iron ought to be such as to obtain the desirable low temperature of oxide-film formation on molten metal which is cooling. The oxide-film formation is counteracted by: increase of temperature, low-sulphur, high-manganese, high-carbon, low-silicon and low-phosphorus contents.

STEEL PRODUCTION in France last month attained the record level of 1,134,000 tons, according to a Paris report. The report adds that production in the first quarter of this year was 26.7 per cent. above that of the first quarter of 1954.

WASHINGTON REPORTS that India and the United States have signed agreements to help India obtain 98,200 tons of steel for industrial development and 58,500 tons of fertilizers. It is further stated that India will acquire the steel in the world market on a competitive basis.

Company News

TEXTILE MACHINERY MAKERS, LIMITED—The dividend of 12½ per cent. for 1954 compares with 10 per cent. paid in the previous year.

WOLVERHAMPTON DIE CASTING COMPANY, LIMITED—The capital is to be increased to £450,000 by the creation of 1,500,000 additional ordinary 2s. shares. Subject to CIC consent it is proposed to offer part of the increased capital by way of rights.

BELL'S ASBESTOS & ENGINEERING (HOLDINGS), LIMITED—For 1954 the final dividend of 12½ per cent. makes a total of 17½ per cent., against an interim dividend of 15 per cent., which was followed by a two-for-one scrip issue and 10 per cent. final in 1953.

SANBRA, LIMITED, brassfounders, etc., of Birmingham—The directors propose a one-for-one scrip issue. Net profit after tax is £82,134, against £25,099 previously, and the total dividend of 25 per cent., which includes a 17½ per cent. final, compares with 20 per cent in the year before.

MONSANTO CHEMICALS, LIMITED—In his annual statement for 1954, the chairman, Mr. Edward A. O'Neal, jun., says that sales increased to the new record of £12,634,616. Direct exports also reached a record level, at £4,799,179 or 38 per cent. of the total. The lower percentage than in 1953 reflects the increase in home sales.

JOSIAH PARKES & SONS, LIMITED, lock and builders' hardware manufacturers, of Willenhall (Staffs)—A final dividend of 10 per cent. is announced, making 15 per cent. for the year to December 12, 1954, on capital increased by a one-for-two scrip issue, compared with 17½ per cent. on the old capital. Trading profit amounted to £198,848, against £136,638.

C. A. PARSONS & COMPANY, LIMITED—The directors recommend a final ordinary dividend of 6¼ per cent., making 10 per cent. for 1954 on capital as trebled by 100 per cent. free scrip issue and 100 per cent. rights issue. In the previous year an interim of 6¼ per cent. was paid on the former capital and a final of 4¾ per cent. on the present capital. Profit increased from £807,862 to £1,484,298.

RANSOMES & RAPIER, LIMITED—Applications for 230,263 shares have been received for the rights issue of 136,000 ordinary 10s. shares at 17s. 6d. each. As only 15,175 shares remained after allotment to stockholders exercising their rights, allotments have been made *pro rata* to existing holdings, with a minimum allotment of 10 shares to each applicant except those holding less than eight shares, who have been allotted one share each. Those applying for less than 10 shares have received full allotment.

CRAVEN BROS. (MANCHESTER), LIMITED, machine-tool makers, etc.—Higher profits and a final dividend of 12½ per cent., making 17½ per cent., are announced. For the previous year an interim dividend of 5 per cent. was followed by a two-for-three scrip issue and a final of 12½ per cent. Profits increased from £96,384 to £126,551, after charging £133,000 (£172,000) for taxation. Treasury consent has been received for the issue of 800,000 ordinary 5s. shares, which will be offered to existing holders in the proportion of two-for-five at 12s. 6d. a share.

NEWTON, CHAMBERS & COMPANY, LIMITED—Output of general engineering castings was increased during 1954, says the chairman, Mr. Peter G. Roberts, MP, in his statement with the accounts. Plans are in hand to develop this side of the business. The winding-up of Thorncliffe Coal Distillation, Limited, resulting in a £750,000 pay-out to Newton Chambers & Company has greatly improved the latter company's financial position. A further £650,000 should be forthcoming when final settlement is made of N.C. Thorncliffe Collieries, Limited, compensation.

MANGANESE BRONZE & BRASS COMPANY, LIMITED—In his statement with the annual report, Mr. J. C. Colquhoun, chairman and managing director, says that the company's order-books are better filled at both of the Ipswich works by some 40 per cent. than they were a year ago. At Birkenhead, on the other hand, the tonnage of propellers on order is only about 85 per cent. of the figure a year ago and export prices will be somewhat keener. The directors recommend a final dividend of 9d. per share, making 1s. per share and a bonus of 3d. per share, making 1s. 3d., against 10½d.

CROFTS (ENGINEERS), LIMITED—The group trading balance for 1954 totalled £827,883, compared with £766,375 for 1953. Referring to current prospects the chairman says that, while there is more business available, competition is keener. All companies in the group, however, have good order-books. To maintain the group's competitive position, substantial capital expenditure will be required; and commitments on this account amount to approximately £243,000. As soon as convenient the directors propose to put forward a scheme for further increasing the capital of the company.

MAVOR & COULSON, LIMITED, mining equipment manufacturers, of Glasgow—The directors recommend a final dividend for 1954 of 7½ per cent., making 12½ per cent. on capital increased by 100 per cent. free scrip issue (equivalent of 10 per cent. on capital as at present). Group trading profit for 1954 was £412,760, against £491,982 in the previous year. The chairman states that the reduction in the value of stocks and work in progress of £206,609 has been brought about by an improvement in the supply of raw materials and the better production position which have enabled a portion of the backlog of orders to be overtaken. After a falling off of orders in 1953, 1954 showed a satisfactory rise, a trend which so far has been continued in the current year

Board Changes

KERRY'S (GREAT BRITAIN), LIMITED—Mr. Roger Gresham Cooke has been appointed to the board.

ALLIED IRONFOUNDERS, LIMITED—Mr. R. G. Elliot Gresham Cooke has been appointed to the board of the company.

HENRY BALFOUR & COMPANY, LIMITED—Mr. Lindsay Burns and Mr. I. M. O. Hutchison have been appointed joint assistant managing directors.

BLACKSTONE & COMPANY, LIMITED—Mr. George Hallewell, chief engineer for the past 20 years, has been appointed a director of the company. He joined the company in 1935, shortly before it was acquired by R. A. Lister & Company, Limited.

VULCAN FOUNDRY, LIMITED—Following the acceptance of the offer made by the English Electric Company, Limited, to ordinary stockholders, Sir George H. Nelson, chairman and managing director of English Electric, has been appointed chairman and Mr. H. G. Nelson, deputy managing director of English Electric, has joined the board, from which Mr. K. F. Pearson and Mr. K. F. Suggett have resigned.

BRITISH OXYGEN COMPANY, LIMITED—Mr. T. E. Potts and Mr. J. Strong have been appointed directors of the company. Both Mr. Potts and Mr. Strong have been in the group organization for many years. Mr. Potts, at present managing director of African Oxygen & Acetylene (Pty.), Limited, and Mr. Strong, at present managing director of the Quasi-Arc Company, Limited, and Fusarc, Limited, will relinquish these appointments.

Pig-iron and Steel Production

Statistical Summary of February Returns

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation. Table I summarizes activities during the past six months. Table II gives production of steel ingots and castings in February, and Table III, weekly average production of finished steel. Table IV gives the production of pig-iron and ferro-alloys in February, 1955, and furnaces in blast. (All figures weekly averages in thousands of tons.)

TABLE I.—*Iron and Steel Price Index and General Summary of Pig-iron and Steel Production.*

Period.	Price Index, 1938 = 100.			Iron-ore output.	Imptd. ore used.	Coke to blast-furnaces.	Pig-iron, ferro-alloys prod.	Scrap used in steel prod.	Steel (incl. alloy).			
	I. & S.	Coal.	All comdts.						Imports.[1]	Prod. ingots, castings.	Delivrs. finished steel.	Stocks.[2]
1953	260	350	323	304	207	237	215	188	18	339	262	962
1954—Sept.[3]	265	365	324	293	231	232	223	212	7	372	293	1,063
Oct. ..	265	365	324	304	237	236	231	210	3	374	292	973
Nov. ..	266	272	326	302	241	341	235	211	6	377	303	900
Dec.[3]	267	372	331	301	236	240	234	196	7	355	285	831
1955—Jan. ..	268	373	332	303	243	240	236	213	11	381	299	828
Feb. ..	269	373	333	315	246	242	242	220	17	394	—	812

TABLE II.—*Production of Steel Ingots and Castings during February*, 1955.

District.	Open-hearth.		Bessemer.	Electric.	All other.	Total.		Total ingots and castings.
	Acid.	Basic.				Ingots.	Castings.	
Derby, Leics., Notts., Northants and Essex ..	—	3.1	13.5 (basic)	1.9	0.2	17.6	1.1	18.7
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire	1.7	30.3	—	2.3	0.4	33.3	1.4	34.7
Yorkshire (excl. N.E. Coast and Sheffield) ..								
Lincolnshire	—	40.1	—	—	0.1	40.0	0.2	40.2
North-East Coast	1.7	73.8	—	1.3	0.5	75.4	1.9	77.3
Scotland	2.6	43.4	—	1.7	0.6	46.5	1.8	48.3
Staffs., Shrops., Worcs. and Warwick	—	19.7	—	1.3	0.7	19.7	2.0	21.7
S. Wales and Monmouthshire	5.5	80.1	6.5 (basic)	1.3	0.2	92.9	0.7	93.6
Sheffield (incl. small quantity in Manchester) ..	9.1	31.2	—	11.2	0.5	50.1	1.9	52.0
North-West Coast	0.1	1.5	5.5 (acid)	0.5	0.1	7.6	0.1	7.7
Total	20.7	323.2	25.5	21.5	3.3	383.1	11.1	394.2
January, 1955	20.2	311.0	25.2	20.8	3.1	370.3	10.3	380.6
e ruary, 1954	20.8	295.7	19.2	17.9	3.7	346.3	11.0	357.3

TABLE III.—*Production of New Non-alloy and Alloy Finished Steel.*

Product.	1953.	1954.	1954		1955.
			Jan.	Dec.	Jan.
Non-alloy steel:					
Ingots, blooms, billets and slabs[4]	4.7	5.1	5.0	4.9	5.2
Heavy rails	8.7	9.6	10.1	8.5	9.8
Sleepers, etc. ..	2.2	1.9	1.0	1.8	1.4
Plates, 3 mm. thick and over ..	46.5	47.0	49.1	48.9	43.7
Other heavy prod.	43.9	45.8	49.2	45.0	47.8
Ferro-con. rods, etc.	5.1	5.9	4.5	6.4	7.0
Wire rods and other rods	15.6	19.7	19.0	21.2	23.1
Light-rolled prod.	44.2	41.2	42.1	43.4	44.9
Bright steel bars ..	6.7	6.3	6.3	6.9	7.5
Hot-rolled strip ..	18.8	21.7	21.5	21.5	24.3
Cold-rolled strip ..	5.2	7.0	6.8	7.2	8.2
Sheets incl. coated	34.1	38.8	36.0	40.4	43.8
Tin, terneplate and blackplate ..	14.9	16.8	16.2	17.4	18.1
Steel tubes, pipes	20.1	20.0	18.8	20.8	21.2
Tube, pipe fitgs.	0.3	0.4	0.4	0.4	0.4
Tyres, wheels, axles	4.4	4.7	5.0	4.3	4.6
Forgings (excl. drop forgings) ..	3.1	2.6	3.0	2.2	2.4
Steel castings ..	4.0	4.0	4.1	4.5	4.1
Tool and magnet steel	0.3	0.2	0.3	0.2	0.3
Total	282.8	298.7	298.4	305.9	317.8
Alloy steel	13.7	13.2	13.7	13.3	14.8
Total deliveries from UK prod.[5] ..	296.5	311.9	312.1	319.2	332.6
Add: Imported finished steel ..	6.8	5.0	5.6	6.2	10.9
	303.3	316.9	317.7	325.4	343.5
Deduct: Intra-industry conversion[6] ..	42.6	41.5	42.3	41.8	46.1
Total net deliveries of new material ..	260.7	275.4	275.4	283.6	297.4

TABLE IV.—*Production of Pig-iron and Ferro-alloys during February*, 1955.

District.	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants and Essex ..	26	—	18.3	26.9	1.1	—	46.3
Lancs. (excl. N.W. Coast) Denbigh, Flints. and Cheshire ..	6	—	13.9	—	—	1.3	15.2
Yorkshire (incl. Sheffield, excl. N.E. Coast) ..							
Lincolnshire ..	10	—	35.9	—	—	—	35.9
North-East Coast	22	4.6	48.5	—	—	1.6	54.7
Scotland	9	0.9	16.1	1.9	—	—	18.9
Staffs., Shrops., Worcs., and Warwick ..	7	—	9.6	1.4	—	—	11.0
S. Wales and Monmouthshire	9	4.8	33.5	—	—	—	38.3
Sheffield ..	2	—	3.4	—	—	—	3.4
North-West Coast	8	16.8	—	0.2	—	1.0	18.0
Total ..	99	27.1	179.2	30.4	1.1	3.9	241.7
January, 1955 ..	99	28.5	174.9	28.0	1.2	3.8	236.4
February, 1954	105	26.5	162.4	28.4	1.3	3.7	222.3

[1] Weekly average of calendar month.

[2] Stocks mainly ingots and semi-finished at the end of the years and months shown.

[3] Five weeks, all tables.

[4] Other than for conversion into any other form of finished steel listed.

[5] Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.

[6] Material for conversion into other products also listed in this table.

News in Brief

ALMIN LIMITED announce their change of address to Almin House, Stoke Poges, Bucks. (Telephone: Slough 25061/4.)

F. E. WEATHERILL LIMITED have removed from Union Row, London, N.17, to Tewin Road, Welwyn Garden City, Herts.

BORAX CONSOLIDATED, LIMITED, removed on April 25 from King William Street, to Borax House, Carlisle Place, London, S.W.1.

J. NEEDHAM & SONS, LIMITED, plan to erect a two-storey extension at Portwood Foundry, Carrington Road, Stockport, Cheshire.

THE *Association Technique de Fonderie de Belgique* is holding its annual congress in conjunction with the Liège Fair on May 5, 6 and 7.

THE ANNUAL GENERAL MEETING of the Netherlands Foundry Technical Association was held last Wednesday at Nijmegen under the presidency of Mr. F. W. E. Spies.

PROCESSES carried out in the precision foundry were shown to members of the Imperial Defence College, when they visited Hadfields Limited, East Hecla Works, Sheffield.

THE COMBUSTION ENGINEERING ASSOCIATION is organizing a conference on "The Operation and Maintenance of Boiler Plants and their Ancillary Equipment" to be held at the Mackworth Hotel, Swansea, on May 5.

FALKIRK IRON COMPANY, LIMITED, have been awarded the contract for the installation of all cooking equipment in the three large kitchens which serve the new buildings now reaching completion at the London Airport Central.

ARGENTINE NATIONAL RAILWAYS have placed an order valued at £250,000 for manganese-steel railway switches with Edgar Allen & Company, Limited, of Sheffield. This order is the largest ever received by the firm's trackway department.

A COLOURED RUBBER PAINT specifically formulated to meet the demands of industrialists, who wish to protect and decorate new and old concrete floors, has recently been introduced by Allweather Paints, Limited, 36, Great Queen Street, London, W.C.2.

THE LAST ISSUE of *Giesserei* to reach this country carries an article describing the making of a 360-*tonne* steel casting for a rolling-mill housing. It required 2,100 moulder/hours to make. Three ladles were used for casting and a fourth for feeding.

TOM REYNOLDS & SON, Albion Foundry, Little Harrowden, Wellingborough, has been incorporated as a limited liability company, and in future will be known as: Reynolds Hygrade Castings, Limited, Albion Foundry, Little Harrowden, Wellingborough.

EMPLOYMENT in the light castings industry in Falkirk and district is in a more satisfactory condition this year than it has been in the spring of the past two years. This was reported by Mr. A. Y. W. Cowie, secretary, at a meeting of Falkirk and District Local Employment Committee. Mr. Cowie said that generally speaking, industry in the area was in a healthy condition but there was a need for new industry employing women.

UNITED STEEL COMPANIES, LIMITED, Sheffield, have bought The Mount, Broomhill Road, Sheffield, as an administrative headquarters to which they will remove their present offices in Westbourne Road, where they have been since 1929. 160 to 180 office workers of United Steel will be accommodated there. United Steel, the biggest iron and steel producers in the British Commonwealth, employ 35,000 people throughout the country.

FOURTEEN PUBLIC-SCHOOLBOYS completed a five-day course on the heavy engineering industry at the Davy and United Engineering Company, Limited, Sheffield, on April 22. Among the schools from which they came were Worksop College, Repton, City of London and Taunton. The course included tours of different branches of the works, practical work at benches, lectures on production, and a talk by Mr. M. A. Fiennes, managing director of Davy and United.

THE FIRST of a projected series of six-weeks' full-time courses in the "Organization and Control of Production" was brought to a conclusion on April 1 by the Department of Industrial Administration in the College of Technology, Birmingham. The students have now returned to their responsible posts in the Midland undertakings which nominated them for the course. Further courses—limited to a maximum of ten students per course—are planned to begin in November and February each academic year.

LAND PYROMETERS LIMITED, of Sheffield, have now completed arrangements for the sale of their products in the United States of America, through "The Fielden Instrument Division of the Robertshaw-Fulton Controls Company." It is noteworthy that British-made instruments produced by Land Pyrometers have aroused considerable interest in the United States, in particular the Land surface pyrometer (as it is claimed no similar instrument of comparable accuracy is available there) and the Land portable glass pyrometer which is capable of measuring the surface temperature of glass.

BLICKVAC ENGINEERING, LIMITED, Bede Trading Estate, Jarrow, announce the re-design of their range of high-vacuum and pressure-impregnation plant. One of the uses to which it can be applied is the sealing of porous castings. The basic design comprises a high-vacuum pump, a control panel and either one or two autoclaves and storage chambers. In the new range of models all controls have been centralized and control has been made so easy that the plant can be operated by either a semi-skilled or a disabled person.

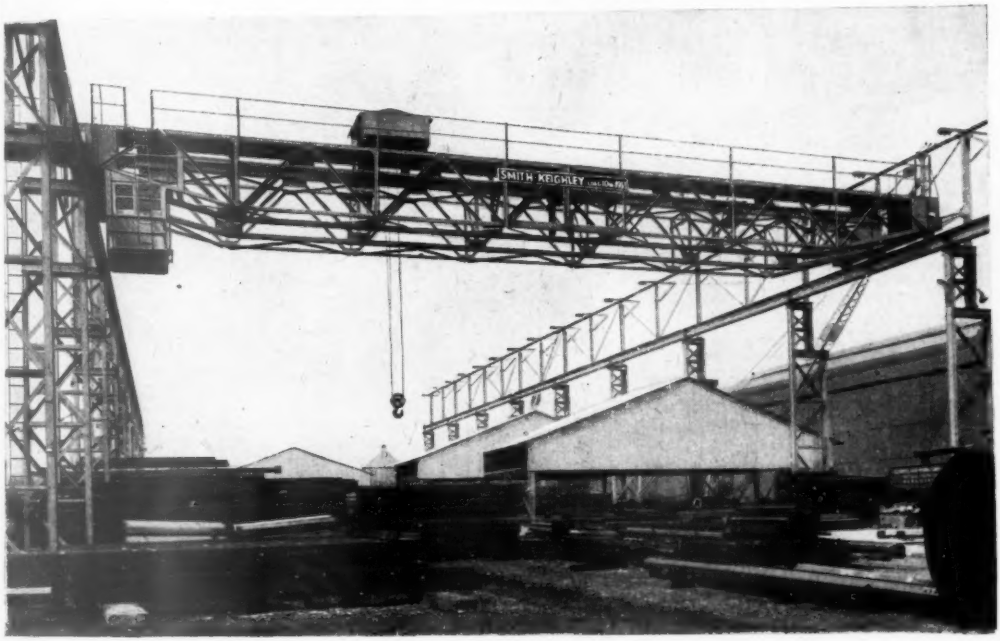
HEPBURN CONVEYOR COMPANY, LIMITED, Rosa Works, Wakefield, have appointed the following area representatives:—N.E. Counties: Inness & Company, 11, Tubwell Row, Darlington; Yorkshire and North Midlands: Mr. A. Liptrot, 131, Cliffe Field Road, Norton Lees, Sheffield, 8; Midlands: Mr. John G. Cassells, A.M.I.MECH.E., Service House, 1, Fleet Street, Birmingham, 3; London and South-eastern Counties: Morrison, Marshall & Hill, Limited, 44/45, Tower Hill, London, E.C.3; Scotland: Balbardie, Limited, 110, Hanover Street, Edinburgh, 2.

A CABLE MAKING MACHINE, claimed to be the largest of its kind in the world, has been made by the Gothic Engineering Company, West Bromwich. Designed by the firm's parent organization, the Trafalgar Engineering Company, London, it weighs over 100 tons and is 126-ft. long. It is being supplied to the Telegraph Construction & Maintenance Company, Limited, at Greenwich, and has been designed for making special type cables, mostly for telephone communication purposes. Patterns, castings, machining and fitting have been carried out at the West Bromwich factory.

A SPECIAL DISPLAY commemorating the 21st anniversary of Aero Research Limited, Duxford, Cambridge, was visited by H.R.H. The Duke of Edinburgh on

(*Continued on page* 470)

Outside, Overhead, and Over All



One of a pair installed in the stockyard of a structural engineering works, the crane featured above is a typical John Smith production designed for outdoor use. It has a lifting capacity of 10 tons and a span of 90 ft. The operating machinery and driver's cabins of all John Smith outdoor cranes are totally enclosed, giving complete protection from the weather. Electro magnets can be fitted if required. Estimates and plans given for all types of overhead and derrick cranes. Enquiries invited.

John Smith CRANES

John Smith (Keighley) Ltd.

P.O. BOX 21, CRANE WORKS, KEIGHLEY, YORKSHIRE. TEL. 2283 4 lines

London Office: Buckingham House, 19/21 Palace St. (off Victoria St.) S.W.1 Tel: Tate Gallery 0377/8
Southern Counties Office: Brettenham House, Lancaster Place, Strand, London, W.C.2. Tel: Temple Bar 1515

News in Brief

(*Continued from page* 468)

April 20. The Duke flew by a helicopter of the Royal Navy from London and was greeted on arrival by Mr. Raymond Needham, O.C., chairman of the company, with Dr. N. A. de Bruyne, managing director, and Mr. R. F. G. Lea, commercial director. In the course of his visit, the Duke witnessed the lifting of a car (weighing 30 cwt. in its cradle) suspended from a 3¼-sq.-in. "Redux"-bonded metal-to-metal joint.

IN THE NEAR FUTURE the Royal Technical College, Glasgow, will experience a substantial increase in its resources for teaching and research as a result of the Government's programme for the further development of higher technological education in selected centres. This is announced in the annual report of the College for the 1953-54 session. Plans for new developments have been prepared, and have received general approval from the University Grants Committee. The work on the Montrose Street extension, which will house the Civil and Mechanical Engineering and Mining Engineering departments, has made good progress.

EARLY THIS MONTH the general managers and sales executives of the Norton Behr-Manning Factories in France, Germany and Italy, joined their British colleagues for the first post-war Norton European sales management conference. The conference was held at the Welwyn Garden City plant of the Norton Grinding Wheel Company, Limited, and was also attended by representatives from the American companies, amongst whom were Mr. A. Donald Kelso and Mr. Frank M. Ryan, president and vice-president respectively of Norton Behr-Manning Overseas Inc., Mr. Ralph M. Johnson, vice-president in charge of sales, and Mr. Edwin E. McConnell, treasurer of Norton Company, Worcester, Mass., USA.

FIGURES presented to members of the Midland Regional Board for Industry in Birmingham on April 19 showed that the unsatisfied demand for labour by Midland industry continues to grow. Last month there were almost 53,000 vacancies in the region—the highest for nearly four years. Another fall in the number of unemployed was registered. The total for mid March was 10,341—562 fewer than the previous month. This represented 0.5 of the insured population compared with the national average of 1.3 per cent. The current issue of the Birmingham Chamber of Commerce *Journal* states that there are upwards of 1,000 schemes in hand for factory extensions and about 27.000 workpeople will be required to man them.

EIGHT SENIOR OFFICERS of the Fighting Services and the Civil Service from the Imperial Defence College, including Air Vice Marshal T. N. McEvoy, who is on the Imperial Defence College staff, Brigadier G. H. Baker, Captain R. M. Smeeton, Brigadier G. C. Gordon Lennox, Mr. Geraghty, of the War Office, Air Commodore Mohammed Asghar Khann, of the Royal Pakistan Air Force, Brigadier R. C. Hiemstra and Group Captain J. G. Davis, accompanied by Mr. E. R. B. Harlock, Deputy Regional Controller, Board of Trade and Ministry of Supply, last week toured the works of David Brown Tractors (Engineering), Limited, Meltham, near Huddersfield, where they saw industrial and agricultural tractors and bulldozers being produced and at work.

G.W.B. FURNACES, LIMITED, Dudley, will be exhibiting on Stand D617/516, Castle Bromwich, the smallest and the largest units in their range of "Powermaster" oil/gas-fired boilers. These units are models 15 and 500 giving an output of 517 lb. and 17,250 lb. of steam per hr. respectively. The "Powermaster" is a completely self-contained packaged, automatic boiler for raising steam up to 250 p.s.i. and for water heating; it is suitable for operating either on fuel-oil of all types or gas, while any model may be fitted with an alternative gas/oil burner permitting rapid changeover from one fuel to the other when required. Two packaged, electrode-type boilers, products of the associated company, Autolec Boilers, Limited, of Harrow, will also be displayed. The first, an electrode steam raiser, rated at 70 kw, suitable for many light industrial purposes, and secondly, a steam jet cleaner, rated at 20 kw.

IT WAS MADE KNOWN on April 23 that the English Steel Corporation, Limited, had been the makers of important parts of Britain's first cyclotron at the Harwell atomic plant and for the even more powerful synchro-cyclotron at Liverpool University. The parts were made between 1947 and 1952. They were electro-magnet yokes, rectangular box-like frames, prefabricated in heavy, mild-steel plate, inside of which were placed two pole pieces, one suspended over the other. The plant for Harwell was the largest of its kind in the world, it was 23 ft. long, nine ft. deep and 18 ft. high. With pole discs nine ft. dia. the total weight of steel used was 525 tons. The Liverpool machine was a magnet 32 ft. wide, 13 ft. deep and 22 ft. high. The two pole discs were 13 ft. dia. Both structures, which are tools for research into the various fields of nuclear physics, were assembled in the Corporation's planing shop at Hawke Street, Sheffield.

MR. F. C. STOCKHAM, works and development engineer of the Wolverhampton Die Casting Company, Limited, and Mr. J. Brittle, factory planning engineer, have recently toured die-casting factories in America with the object of gaining information about modern foundry developments. The Wolverhampton Die Casting Company is soon to erect a new factory at Bloxwich, Walsall, which it is hoped will be one of the best equipped in either this country or America. Mr. Kenneth Whitehead, a director, states that the company hopes to increase its output for the motor industry by 50 per cent.—at present it is in the region of 85 to 90 tons of die-castings a week which represents some 1,500,000 individual castings. One of the features of the new plant will be a conveyor storage system to be built by Fisher & Ludlow, Limited, Birmingham, and it is anticipated that the new plant will come into production at the end of 1956. Before that date the company is to build an extension at Graiseley Hill covering some 20,000 sq. ft. which will act as a pilot plant.

THE PERMANENT MAGNET ASSOCIATION Celebrity Lecture was delivered by Professor L. F. Bates, PH.D., D.SC., F.R.S., at the Royal Victoria Station Hotel, Sheffield, recently. It was of interest to Sheffield metallurgists and the permanent-magnet industry because it dealt with the development of the domain concept of ferromagnetism, initially postulated by Pierre Weiss to explain the fact that one may take a piece of unmagnetized iron and yet by the application of a weak magnetic field one may easily magnetize it strongly. The iron is supposed to consist of a collection of small regions or domains each strongly magnetized, but the directions of magnetization of the several domains are so randomly orientated when the iron is in the unmagnetized state that they neutralize one another, while in the strongly magnetized state their directions of magnetization are practically parallel to one another. In recent years the domain concept has been greatly developed to account for some of the magnetic properties of single crystals of the ferromagnetic metals, of polycrystalline, rolled silicon-iron and, finally, of permanent-magnet materials like Alcomax.

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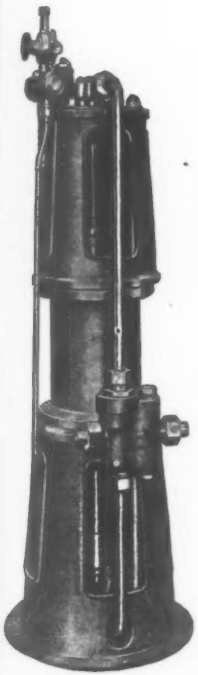

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Personal

MR. FRANK R. HURST, chairman and managing director of Samuel Osborn & Company, Limited, Sheffield, has been chosen as next president of Sheffield Chamber of Commerce.

MR. JOHN B. YOUNG, C.A., has been appointed a director of G. & J. Weir, Limited, engineers, Glasgow. Mr. Young, who is 30, has been in the service of the firm for the past seven years.

MR. J. W. DORGAN, apprentice supervisor at Newton Chambers & Company, Limited, Thorncliffe Works, Chapeltown, near Sheffield, since 1945, has been awarded the Silver Scout, the highest service award in scouting.

MR. E. D. KNIGHTS has been elected president of the East Midlands Metallurgical Society, he is a research metallurgist at British Railways, Derby. He succeeds Dr. H. K. LLOYD, Professor of Metallurgy at Nottingham University.

NEWCASTLE-NORTH Labour Party on April 14 chose MR. BASIL CHISHOLM, an ironmoulder of Consett, Co. Durham, as their prospective candidate to oppose Major G. Lloyd George, the Home Secretary, at the coming general election.

DR. EDWARD LEIGHTON YATES, senior lecturer in Physics at the University of Sheffield, has been appointed to the chair of Physics at the University College of Rhodesia and Nyasaland. He is expected to take up his new post in November.

MR. S. C. BOND, transport manager of Stanton Iron Works Company, Limited, was re-elected president on April 20 of the Traders' Road Transport Association, representing "C" licence holders. He was also re-appointed chairman of the Association's national Council.

MR. A. G. B. OWEN, chairman of the Rubery Owen group, is, in June, to be installed as national president for 1955-56 of the National Sunday School Union and Christian Youth Service, in succession to Alderman CUTHBERT L. ACKROYD, an ex-Sheriff of the City of London.

MR. T. A. CROWE, of the North British Locomotive Company, Limited, Glasgow, and Mr. H. H. HAGAN, of Lobnitz & Company, Limited, Renfrew, have been appointed vice-presidents of the Institution of Engineers & Shipbuilders in Scotland at the annual meeting in Glasgow.

MR. J. ROBERTS, works metallurgist with the English Steel Corporation, Limited, Sheffield, left in the Queen Mary on April 21 for New York. He will be away for a month visiting the Pittsburgh works of the Corporation to exchange ideas under a technical-aid agreement with the American firm.

MR. J. RUTTER has been appointed a technical representative of the Jenolizing Company, Limited. Previously he was preparing and controlling painting specifications for the Commonwealth Government in Sydney, Australia, and he brings to his new appointment a wide knowledge of paint technology.

ACHESON COLLOIDS LIMITED, of Pall Mall, London, S.W.1, announce the following promotions and appointments:—Mr. H. G. DAVIS, B.SC., formerly assistant technical manager, head office, to be deputy works manager at Plymouth; Mr. J. B. MACLEAN, B.A., has joined the export section of the sales department; and Mr. G. C. B. ANDREW to be publicity officer.

MR. JAMES HENDRY, who has been some 20 years in the service of Smith & Wellstood, Limited, Bonnybridge, the last seven years of which he was foreman in the C.W.S. pattern filing shop, has left to take up an appointment on the staff of the fibre-glass department of a plastics factory near Liverpool. The foremen of the firm presented him with a monetary gift.

MR. JOHN RUFFE-WILLIAMS, personnel officer at the Davy and United Engineering Company, Limited, Darnall, Sheffield, for the past three years, has been appointed personnel officer to the Projectile and Engineering Company, Limited, London, and takes up the appointment at the beginning of next month. He was formerly with Daniel Doncaster and Sons, Limited, Sheffield. In 1953 he was appointed chairman of the Sheffield Industrial Safety Group, of which he is now a member of the executive committee.

VISCOUNT WEIR OF EASTWOOD is to retire from office as a director and chairman of G. & J. Weir, Limited, Glasgow, engineers, with which he has been associated for over 57 years. In recognition of his service with the company, he is to be appointed the first hon. president of the Weir group of companies. On his retirement at the forthcoming annual general meeting of the company, Lord Weir is to be succeeded by the Hon. J. KENNETH WEIR, the present managing director. This post is now to be held jointly by the Hon. KENNETH WEIR and Mr. J. RUSSELL LANG.

MR. A. S. H. SAWERS, who was appointed junior vice-president of the Scottish branch of the Institute of British Foundrymen at the annual general meeting in the Royal Technical College, Glasgow, served his apprenticeship with Cruickshank & Company, Limited, Denny. He is at present general manager of Aluminium Castings, Limited, Ingliston Foundry, Greenock. He is a very active member of the Institute and during the Institute's international events he visited factories in America, Italy and Belgium.

Obituary

MR. GEORGE ERNEST SLATER, metallurgical chemist at Firth Brown, Limited, has died.

MR. JOHN SHARP, of Glasgow, who died on April 15, was a prominent member of the engineering profession in the West of Scotland. He was a former chairman of James Allan & Sons, Limited, Elmbank Foundry, Glasgow, and was holder of a Whitworth Scholarship. He was 95.

Major FRANK BERNARD HALFORD, chairman and technical director of the de Havilland Engine Company, Limited, died on Saturday at the age of 61. Among the aeroplane engines for which he was responsible was the de Havilland Gipsy, Goblin, and Ghost. He was president of the Royal Aeronautical Society in 1951 and was also a director of the de Havilland Aircraft Company, Limited.

MR. H. R. G. STONEY, a director of Steel Nut & Joseph Hampton, Limited, Darlaston, and of Westley Richards & Company, Limited, Birmingham, died on April 19 at the age of 56. Earlier in his career Mr. Stoney was managing director of Nortons-Tividale Limited and before taking up the directorship with that company, was a member of the firm of Urwick Orr & Partners Limited.

IT IS LEARNED with regret that one of the boys who lost his life in the fire disaster in Central France recently was the son of Michael Wallwork, of Henry Wallwork & Company, Limited, Manchester.

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LINING—A rammed lining of Carbofrax packed by a superior monolithic insulating material. Special linings supplied to meet particular specifications.

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COKE—Includes low pressure fan with direct drive by totally enclosed "Brook" electric motor. A Damper, regulating air supply is incorporated.

GAS—Efficient Gas Burner with control gear, including High Pressure Fan with direct drive by totally enclosed "Brook" electric motor. Secondary air is provided by directly driven low pressure fan and "Brook" totally enclosed electric motor.

OIL—A proprietary Burner with good "turn down" range and complete control gear.

Includes air supply by fans as in the case of gas firing specified above.

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POL/13

Raw Material Markets

Iron and Steel

Pig-iron outputs in March were slightly below the February figures. This is no doubt largely accounted for by the severe weather, which not only adversely affected operations at the furnaces, but also delayed the receipt of essential raw materials by boat and rail, with the result that in some instances stocks were used up. With the new plants which will be brought into production during the year, outputs should rise appreciably, and while the steelworks will benefit mostly, it is hoped that some relief will be afforded to the foundries, many of which are badly in need of additional supplies, particularly of the low- and medium-phosphorus irons and hematite.

Most of the foundries have plenty of business on hand, but insufficient raw materials to implement it. The engineering foundries are very busy, but are finding the utmost difficulty in obtaining the pig-iron and scrap they require. The supply of the low- and medium-phosphorus irons shows no improvement, and the outlook for the future is not very bright. Hematite grows more difficult daily, but some improvement is expected from the blowing-in of a furnace on the West Coast. Meanwhile, the engineering and speciality foundries are maintaining production as best they can by securing all available supplies of suitable home-produced irons, and some have booked consignments of foreign pig-iron to ensure having a reserve at hand.

The light, jobbing, and textile foundries maintain fairly good outputs, but they also are incommoded by the erratic supply of high-phosphorus pig-iron, which only just about meets current consumption needs; in fact, many foundries could step up production given additional supplies of pig-iron and scrap.

The foundries generally are receiving deliveries of foundry coke in accordance with allocated tonnages. Increased supplies are difficult to secure, as most producers are fully committed for their outputs. The Ministry of Fuel and Power has advised the foundries that supplies of foundry coke for the summer period will be based upon the present level, although it is pointed out that the demand for some brands of coke may exceed the supply.

The re-rollers are striving desperately to increase their supplies of steel semis. With the ever-increasing outputs of steel ingots it was hoped that home steelworks would be able to spare them extra tonnages of billets, blooms, and slabs, but these are not yet forthcoming, and re-rollers are pinning their hopes on further deliveries of material from abroad, which, reports indicate, will be forthcoming in the near future. Demand for heavy finished products is fully maintained.

Non-ferrous Metals

Rising stocks of copper are indicated in figures published by the British Bureau of Non-Ferrous Metal Statistics for February. From 62,771 tons at January 31, they had risen to no less than 70,185 tons at the end of February, of which more than 5,000 tons of the increase was due to additions to the tonnage of refined copper. Consumption was slightly lower, due, perhaps, to the shorter month, at 50,705 tons, against 51,218 tons. The breakdown of the January figure showed 39,705 tons of refined copper and 11,513 tons of scrap, whereas in February the corresponding figures were 36,906 tons and 13,799 tons. There can be little doubt that the prolonged strike in Rhodesia compelled manufacturers to absorb more secondary metal than previously.

Stocks of zinc fell by 2,350 tons to 45,679 tons, while consumption, all grades, in February, at 28,814 tons, was nearly 400 tons less than in January. There was a noteworthy increase in stocks of lead—from 32,274 tons to 39,461 tons—due entirely to a build-up in the country's holding of imported virgin lead. The situation in this metal is now very comfortable and there would seem to be no need for a premium in the market for prompt metal. Consumption, including scrap and remelted, was 28,926 tons, against 29,062 tons in January. Usage of tin in February was virtually unchanged, at 1,843 tons, but stocks were up from 4,353 tons to 4,821 tons at the end of the month.

The stalemate in tin continues, for there is still no decision in the United States about the fate of the Texas smelter. Linked with this delay is almost certainly Indonesia's reluctance to commit herself to observance of the tin scheme, the fate of which still hangs in the balance. Indeed, it may be that should the US decide, after all, to carry on the smelter for another 12 months, the Indonesians will in turn decide that they need not face up to a reduction in the annual output which membership of the scheme imposes upon them.

Last Thursday the Board of Trade announced the release of a further 20,000 tons of copper, blister this time. Three months copper plunged to £302 10s., but recovered and on balance the week closed only £4 down, at £313. Cash was £323, which showed a loss of £2. Zinc lost 10s., both positions, lead lost 15s., but tin was 10s. up for cash and forward.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* April 21, £321 10s. to £322 10s.; April 22, £322 10s. to £325; April 25, £316 10s. to £317 10s.; April 26, £306 to £307; April 27, £318 to £320.

Three Months: April 21, £310 to £311; April 22, £312 to £313; April 25, £307 to £307 10s.; April 26, £295 10s. to £296; April 27, £295 10s. to £296.

TIN, Standard—*Cash:* April 21, £717 10s. to £719; April 22, £716 10s. to £717 10s.; April 25, £715 to £715 10s.; April 26, £715 to £716; April 27, £715 10s. to £716.

Three Months: April 21, £718 10s. to £719; April 22, £717 10s. to £718 10s.; April 25, £716 to £717; April 26, £715 to £716; April 27, £716 10s. to £717.

LEAD—*Second half April:* April 21, £104 10s. to £104 15s.; April 22, £104 5s. to £104 10s.; April 25, £104 2s. 6d. to £104 5s.; April 26, £103 to £103 5s.; April 27, £103 10s. to £103 15s.

Second half July: April 21, £104 5s. to £104 10s.; April 22, £104 5s. to £104 10s.; April 25, £104 to £104 5s.; April 26, £103 to £103 5s.; April 27, £103 15s. to £104.

ZINC—*Second half April:* April 21, £89 to £89 5s.; April 22, £89 5s. to £89 10s.; April 25, £88 15s. to £89; April 26, £87 15s. to £88; April 27, £88 to £88 5s.

Second half July: April 21, £87 15s. to £88; April 22, £87 15s. to £88; April 25, £87 10s. to £87 15s.; April 26, £87 to £87 5s.; April 27, £87 5s. to £87 10s.

C. & L. HILL, LIMITED, a member company of the Owen Organization will be exhibiting at the B.I.F., Castle Bromwich, on Stand No. D616/717, a selection of non-ferrous sandcastings; "Hilchill" phosphor bronze bars; aluminium alloy gravity die-castings; and shell-moulded castings.

AMONG the range of products to be shown by Dohm, Limited, 167, Victoria Street, London, S.W.1, on Stand No. E1 and E8 at Olympia a new material—Dohmfrac, will be on show. This is a silica or zircon/resin-coated sand mix for shell moulding, made by a patented process of sand grain coating. It is available in grades for varying duties.

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Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

April 27, 1955

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £15 12s. 0d.; Birmingham, £15 5s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £17 13s. 9d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £18 9s. 3d.

Scotch Iron.—No. 3 foundry, £18 2s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £20 4s. 0d.; South Zone, £20 6s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £21 1s. 6d.; South Zone, £21 4s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £18 2s. 6d.; Scotland (Scotch iron), £18 9s. 0d.; Sheffield, £19 7s. 6d.; Birmingham, £19 14s. 6d.; Wales (Welsh iron), £18 9s. 0d.

Basic Pig-iron.—£15 15s. 6d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots).—40/55 per cent., £40 15s. 0d., basis 45 per cent. Si, scale 15s. per unit; 70/84 per cent., £63 0s. 0d., basis 75 per cent. Si, scale 16s. per unit.

Ferro-vanadium.—50/60 per cent., 23s. 8d. to 25s. 0d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 11s. 0d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £161 0s. 0d. to £165 0s. 0d. per ton; 38/40 per cent., £258 0s. 0d. to £262 0s. 0d. per ton.

Ferro-tungsten.—80/85 per cent., 15s. 10d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 18s. 10d. per lb. of W.

Ferro-chrome (6-10 ton lots).—4/6 per cent. C, £80 0s. 0d. to £82 0s. 0d., basis 60 per cent. Cr, scale 25s. 0d. per unit; over 6 per cent. C, £78 0s. 0d. to £80 0s. 0d., basis 60 per cent. Cr, scale 24s. 0d. per unit; 2 per cent. C,* 1s. 10d. per lb. Cr; 1 per cent. C,* 1s. 11d. per lb. Cr; 0.15 per cent. C,* 1s. 11d. to 2s. 1d. per lb. Cr; 0.10 per cent. C,* 1s. 11d. to 2s. 2d. per lb. Cr; 0.06 per cent. C,* 2s. 3d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 7¼d. to 7s. 1d. per lb.

Metallic Manganese.—93/95 per cent., carbon-free, £225 0s. 0d. to £232 0s. 0d. per ton; 96/98 per cent., £259 0s. 0d. to £265 0s. 0d. per ton.

Ferro-columbium.—60/75 per cent., Nb + Ta, 52s. 6d. to 70s. 0d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £53 17s. 6d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £25 5s. 0d.; tested, 0.08 to 0.25 per cent. C, £26 5s. 0d.; hard (0.41 to 0.60 per cent. C), £27 10s. 0d.; silico-manganese, £34 10s. 0d.; free-cutting, £29 6s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £32 17s. 0d.; silico-manganese, £34 10s. 0d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £29 13s. 6d.; basic, hard, over 0.41 up to 0.60 per cent., C, £30 16s. 0d.; acid, up to 0.25 per cent. C, £33 15s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £31 1s. 6d.; boiler plates (N.-E. Coast), £33 11s. 6d.; floor plates (N.-E. Coast), £32 10s. 6d.; sectional material, N.-E. Coast, £29 4s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £31 19s. 6d.; flats, 5 in. wide and under, £31 19s. 6d.; hoop and strip, £33 1s. 6d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £34 5s. 0d.; black sheets (hand mill), 17/20 g., £43 13s. 6d.; galvanized corrugated sheets, 24 g., £55 4s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £54 7s. 9d.; nickel-chrome, £76 7s. 9d.; nickel-chrome-molybdenum, £86 8s. 6d.

NON-FERROUS METALS

Copper.—Cash, £318 0s. 0d. to £320 0s. 0d.; three months, £307 0s. 0d. to £308 0s. 0d.; settlement, £320 0s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 3s. 1d. per lb.; rods, 360s. 6d. per cwt. basis; 20 s.w.g., 391s. 9d. per cwt.

Tin.—Cash, £715 10s. 0d. to £716 0s. 0d.; three months, £716 10s. 0d. to £717 0s. 0d.; settlement, £716 0s. 0d.

Lead (Refined Pig).—Second half April, £103 10s. 0d. to £103 15s. 0d.; second half July, £103 15s. 0d. to £104 0s. 0d.

Zinc.—Second half April, £88 0s. 0d. to £88 5s. 0d.; second half July, £87 5s. 0d. to £87 10s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £119 15s. 0d.; rolled zinc (boiler plates), all English destinations, £117 10s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £103 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 2s. 5½d. per lb.; rods, drawn, 3s. 3¾d.; sheets to 10 w.g., 323s. 9d. per cwt.; wire, 3s. 1d.; rolled metal, 309s. 6d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £206; B6 (85/15), £298; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £260; HTB2 (38 tons), £272; HTB3 (48 tons), £280.

Gunmetal.—RCH, 3/4 per cent. tin, —; BS1400, LG2 (85/5/5/5), £282; LG3 (86/7/5/2), £293; G1 (88/10/2/½), £366; (88/10/2/1), £356.

Phosphor Bronze.—BS1400, PB1 (AID released), £381 per ton.

Phosphor Bronze Strip, etc.—Strip, 450s. 0d. per cwt.; sheets to 10 w.g., 473s. 6d. per cwt.; wire, 4s. 7½d. per lb.; rods, 4s. 0d.; tubes, 3s. 10½d.; chill cast bars: solids 4s. 0d., cored 4s. 1d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 10½d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 4d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 3d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 3d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £108 10s. 0d. to £109 0s. 0d. Nickel, £519 0s. 0d. Aluminium, ingots, £163 0s. 0d.; aluminium bronze (BS1400), AB1, £335; AB2, £340. Solder, brazing, BS1845, 2s. 9d. lb.; granulated, 3s. 0d. lb.

* Averag e 68-70 per cent.